

Revision of the Genus *Pandanus* Stickman, Part 16 Species Discovered in Thailand and Vietnam

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THE FOLLOWING NEW species are all but one based upon specimens collected by others and preserved in Bangkok, either in the herbarium of the Department of Agriculture at Kasetsart University or in the herbarium of the Royal Forestry Department.

SECTION *Acrostigma*

Pandanus biplicatus sp. nov. (sect. *Acrostigma*)

Fig. 192

DIAGNOSIS HOLOTYPE: Licet acaulescens, foliis 1.01 m longis 3.6 cm latis parte $\frac{1}{3}$ basali subcoriacea parte ultima crassiter chartacea supra viridibus infra pallidis et licet glaucis 1-sulcatis acute 2-plicatis in sectione mediali M-formatis et cum 41 nervis parallelis secundariis in quoque dimidio, nervis tertilis in parte $\frac{2}{3}$ ultima conspicuis et reticulis anguste oblongis formantibus, laminis ligulatis subiter in apice trigono subulato 3 cm longo 1–2 mm lato diminuentibus basi amplexicauli et inermi sed ex 14–15 cm marginibus cum aculeis 1.5–2 mm longis 2–8 mm separatis subulato-serratis complanatis luteis, midnervo infra ex 20 cm cum aculeis 2–3.5 mm longis 8–15 mm separatis subulatis reflexis, in sectione mediali marginibus cum aculeis 1.5–2 mm longis 5–10 mm separatis subulatis proxime adscendentibus, midnervo infra cum aculeis 2.5–3 mm longis 15–22 mm separatis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum serrulis 0.2–0.3 mm longis 1.5–3 mm separatis, in pagina superiori ad apicem plicis cum serrulis 0.2–0.3 mm longis 1–4 mm separatis, inflorescentia foeminea erecta et recta, pedunculo 22–30 cm longo gracili clavato 9–12 mm diametro in apice folioso bracteato, bracteis herbaceis coloratis sed in sicco

nigro-brunneis infima 19 cm longa 23 mm lata lineari-lanceolata ad basem integra parte $\frac{1}{3}$ ultima proxime subulato-serrata, syncarpio 9.5 cm longo 7.2 cm diametro obovoideo-ellipsoideo cum drupis numerosis, eis 32–34 mm longis 6–7.5 mm latis 4–6 mm crassis anguste oblanceofusiformibus 1-carpelatis parte $\frac{1}{3}$ supra libera corpore 24–26 mm longo oblanceoloideo lateribus planis, pileo 13–14 mm longo cartilagineo basi 5–6 mm alta rotundato-pyramidali 6-angulata, stylo 6–8 mm longo crassiter subulato anguloso divergenti subsinuoso, stigmatibus 3–4 mm longo distali lineari brunneo sulcato papilloso in apice extenso, endocarpio in parte $\frac{1}{3}$ infera obovoideo cartilagineo stramineo in apice truncato lateribus 0.1 mm crassis, semine 8–9 mm longo obovoideo, mesocarpio apicali 7 mm longo cum medulla alba delicata completa, mesocarpio basali 5–6 mm longo fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Perhaps acaulescent; leaves about 1.01 m long, 3.6 cm wide, the lower $\frac{1}{3}$ subcoriaceous, the outer $\frac{2}{3}$ thick chartaceous, green above, pale and apparently glaucous below, 1-furrowed above the midrib, sharply 2-pleated, at midsection M-shaped in section and with 41 parallel secondary veins in each half, tertiary cross veins conspicuous in outer $\frac{2}{3}$'s, forming narrow oblong meshes, the blade ligulate, abruptly narrowed to a trigonous subulate apex 3 cm long, 1–2 mm wide, the base amplexicaul and unarmed, but beginning at 14–15 cm the margins with prickles 1.5–2 mm long, 2–8 mm apart, subulate-serrate, flat, yellowish; the midrib below beginning at 20 cm with prickles 2–3.5 mm long, 8–15 mm apart, subulate, reflexed; at midsection the margins with prickles 1.5–2 mm long, 5–10 mm apart, subulate, closely ascending; the midrib below with prickles 2.5–3 mm long, 15–22 mm apart, subulate, ascending; on the subulate apex the margins and midrib below with serrulations 0.2–0.3 mm long, 1.5–3 mm apart; on upper

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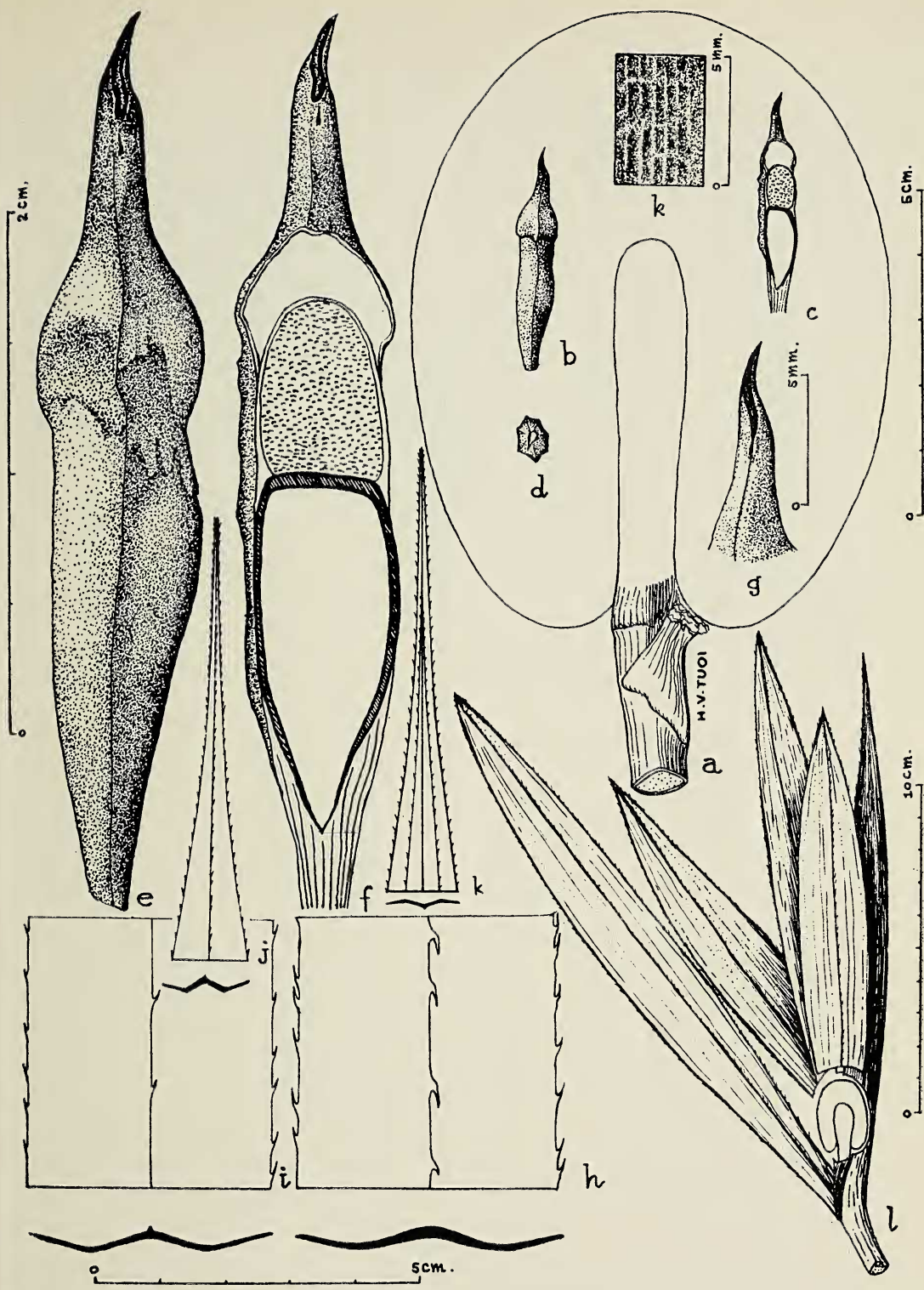


FIG. 192. *Pandanus biplicatus* St. John, from holotype. *a*, Syncarp profile, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, apical view, $\times 1$; *e*, drupe, lateral view, $\times 4$; *f*, drupe, longitudinal median section, $\times 4$; *g*, style and stigma, distal view, $\times 4$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$; *k*, leaf apex, upper side, $\times 1$; *l*, young pistillate inflorescence, lateral view, $\times \frac{1}{2}$.

side towards the apex the pleats with serrulations 0.2–0.3 mm long, 1–4 mm apart; pistillate inflorescence erect, straight; peduncle 22–30 cm long, slender clavate, 9–12 mm in diameter at apex, leafy bracted; floral bracts herbaceous, colored, drying blackish brown, the lowest one 19 cm long, 23 mm wide, linear-lanceolate, entire below, the outer $\frac{1}{3}$ closely subulate-serrate; syncarp 9.5 cm long, 7.2 cm in diameter, obovoid-ellipsoid, with numerous drupes, these 32–34 mm long, 6–7.5 mm wide, 4–6 mm thick, narrowly oblance-fusiform, 1-celled, upper $\frac{1}{3}$ free, the body 24–26 mm long, oblanceoloid, the sides flat; pileus 13–14 mm long, cartilaginous, the base 5–6 mm high, rounded pyramidal, 6-angled, tapering upwards; style 6–8 mm long, stout subulate, angled, divergent, slightly sinuous, but nearly straight; stigma 3–4 mm long, distal, linear, brown, creased, papillose, running to the apex; endocarp in lower $\frac{1}{3}$, obovoid, the apex truncate, cartilaginous, stramineous, the walls 0.1 mm thick; seed 8–9 mm long, obovoid; apical mesocarp 7 mm long, filled with a delicate white pith; basal mesocarp 5–6 mm long, fibrous and fleshy.

HOLOTYPE: Thailand, Lower Siam, Kopah, Jaujau, 9 Dec. 1917, *Md. Haniff & Md. Nur* 2,703 (SING).

DISCUSSION: *P. biphlicatus* is a member of the section *Acrostigma*, as is its closest relative, *P. pseudofoetidus* Martelli of Burma, a species which has the syncarp subglobose; drupes 20 mm long, 5 mm wide; endocarp 10 mm long; and the apical mesocarp 4 mm long. *P. biphlicatus* has the syncarp obovoid-ellipsoid; drupes 32–34 mm long, 6–7.5 mm wide; endocarp 13 mm long; and the apical mesocarp 7 mm long.

The new epithet is from the Latin, *bi*, twice, *plicatus*, folded, in reference to the two longitudinal pleats of the leaves.

Pandanus monotheca Martelli, Soc. Bot. Ital., Bul. 303, 1904; *Webbia* 4(2): pl. 41, fig. 18–20, 1914.

THAILAND: Bāchaw, Pattani, evergreen forest, 600 m. alt., July 14, 1923, *A. F. G. Kerr* 7,191 (BK). This species, originally described from Malaya, is here recorded for the first time for Thailand.

Pandanus Toei sp. nov. (sect. *Acrostigma*)

Figs. 193, 194

NOM. VERN.: "toei."

DIAGNOSIS HOLOTYPI: Acaulescens, foliis 1.3 m longis in media 20 mm latis proxima basem 15–18 mm latis supra midervum sulcatis 2-plicatis chartaceis supra viridibus infra pallidioribus ligulatis in apice 9 cm longo 0.3–0.8 mm lato subulato trigono in sectione mediali cum 26–29 nervis secundariis parallelis in quoque latere, nervis tertilis non evidentis basi amplexicauli et inermi sed ex 4.5–6.5 cm marginibus cum aculeis 1.3–2 mm longis 3–7 mm separatis subulatis adscendentibus luteis, midnervo infra ex 6–8.5 cm cum aculeis 1.5–2.5 mm longis 6–15 mm separatis crassiter subulatis arcuatis reflexis, in sectione mediali marginibus cum serrulis 0.2–0.6 mm longis 3–7 mm separatis, midnervo infra cum aculeis 2 mm longis remotis subulatis arcuatis reflexis vel adscendentibus, in apice subulato marginibus et midnervo infra cum serrulis 0.2 mm longis 0.5–2 mm separatis, inflorescentia foeminea terminali erecta cum syncarpio unico, pedunculo 15 cm longo clavato trigono in apice 5 mm diametro in dimidia ultima cum bracteis foliosis paucis eis superis 40–50 cm longis 15–18 mm latis, syncarpio 3.5 cm diametro globoso viridi cum circa 160 drupis, eis 15–18 mm longis 4–5 mm latis 3–4 mm crassis subfusiformibus parte $\frac{2}{3}$ supera libera corpore oblanceo-ellipsoideo obtuso 10–12 mm longo, pileo 9–11 mm longo basi 2–3 mm alto oblato-pyramidali-hemispherico laevi 5–7-anguloso angulis in stylo continuis, stylo 5–7 mm longo valido 5–7-anguloso subulato proxime arcuato parte exteriori osseosa lucida lutea, stigmata 2.5–3 mm longo distali sublineari sulcato brunneo papilloso paene ad apicem extento, endocarpio in tertia infera cartilagineo luteo muris 0.1 mm crassis intra lucidis, semine 6–7 mm longo 2–2.5 mm diametro oblanceoloideo truncato, mesocarpio apicali 2 mm longo hemispherico vel oblato-hemispherico et cum membranibus medullosis albis, mesocarpio basali fibroso et carnosio.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Acaulescent, or decumbent with the stem 20 cm tall, 12–22 mm in diameter, brown, smooth; leaves 0.96–1.3 m long, 20 mm wide near the middle, 15–18 mm wide near the base, 1-fur-

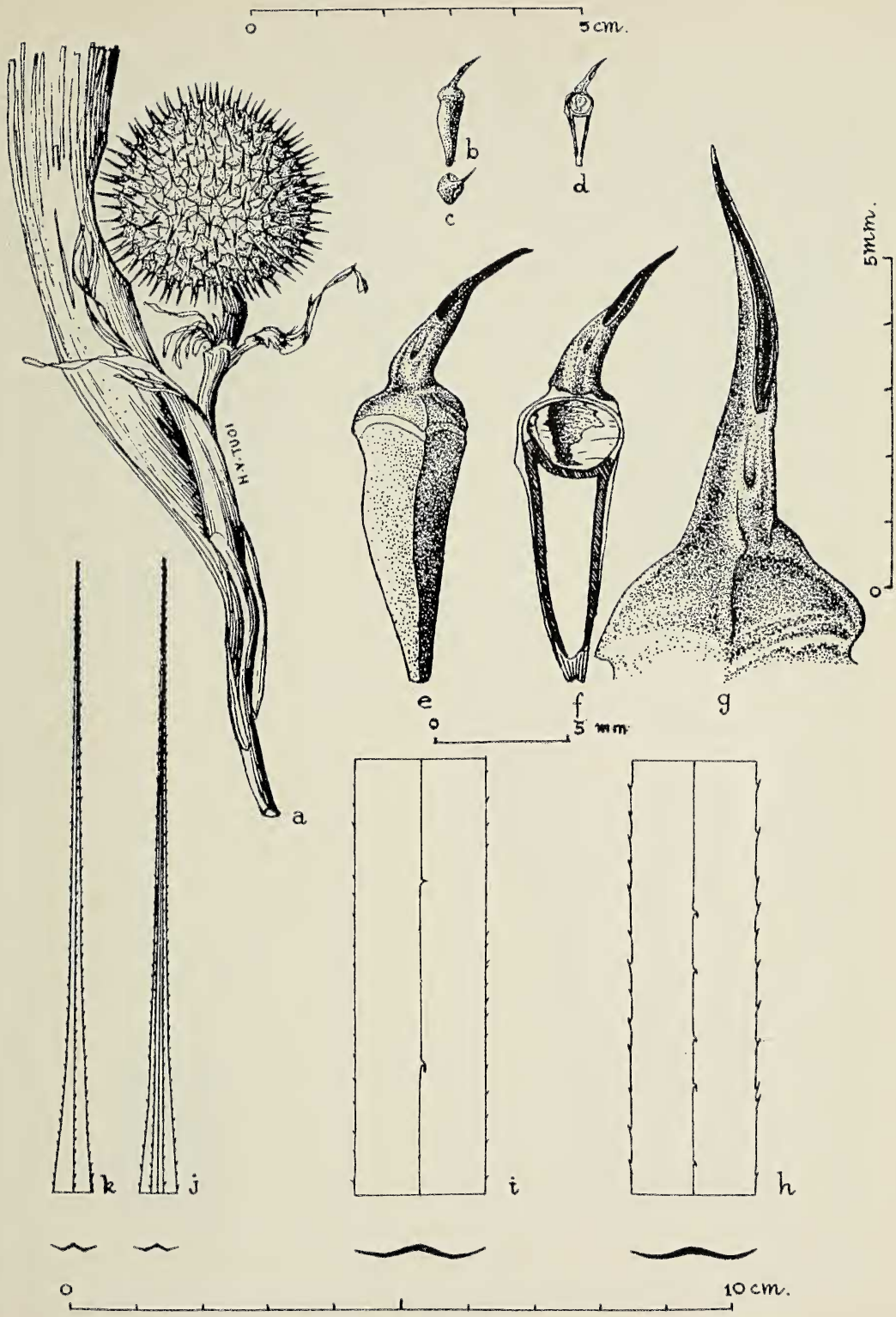


FIG. 193. *Pandanus Toei* St. John, from holotype. *a*, Peduncle and syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, apical view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e*, drupe, lateral view, $\times 4$; *f*, drupe, longitudinal median section, $\times 4$; *g*, style and stigma, distal view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, upper side, $\times 1$; *k*, leaf apex, lower side, $\times 1$.



FIG. 194. *Pandanus Toei* St. John, from *Smitinand 1,391*. *a*, Staminate inflorescence, $\times 1$; *b*, axis and stamens, $\times 10$; *c*, leaf base, lower side, $\times 1$; *d*, leaf middle, lower side, $\times 1$; *e*, leaf apex, upper side, $\times 1$; *f*, leaf apex, lower side, $\times 1$; *g*, secondary longitudinal veins and tertiary cross veins, at midsection, lower side, $\times 4$.

rowed over the midrib, 2-pleated, chartaceous, green above, paler green below, ligulate, tapering to a 9 cm subulate, trigonous apex 0.3–0.8 mm wide, at midsection with 26–29 secondary parallel veins in each half, the base unarmed, but beginning at 4.5–6.5 cm the margins with prickles 1.3–2 mm long, 3–7 mm apart, subulate, ascending, yellowish; the midrib below beginning 6–8.5 cm up with prickles 1.5–2.5 mm long, 6–15 mm apart, stout subulate, fully reflexed arcuate; at midsection the margins with serrulations 0.2–0.6 mm long, 3–7 mm apart, the midrib below with remote prickles 2 mm long, subulate, arcuate, reflexed or ascending; on the subulate tip the margins and midrib below with serrulations 0.2 mm long, 0.5–2 mm apart; pistillate inflorescence terminal, erect, with 1 syncarp or rarely with a small secondary one; peduncle 15 cm long, clavate, trigonous, 5 mm in diameter at apex, with a few leafy bracts on upper half, the upper bracts 40–50 cm long, 15–18 mm wide; syncarp 2.5–4.5 cm in diameter, globose to ellipsoid, green, bearing about 160 drupes, these 15–18 mm long, 4–5 mm wide, 3–4 mm thick, subfusiform, upper $\frac{2}{3}$ free, the body oblance-ellipsoid, obtuse, 10–12 mm long; pileus 9–11 mm long, the base 2–3 mm high, oblate pyramidal-hemispheric, smooth, 5–7-angled, the angles continuing well up the style; style 5–7 mm long, stout, 5–7-angled, subulate, proximally arcuate, the outer part bony, shining, yellowish; stigma 2.5–3 mm long, distal, sublinear, creased, brown, papillose, running almost to the apex; endocarp in lower $\frac{1}{3}$, cartilaginous, yellowish, the walls 0.1 mm thick, the inside shining; seed 6–7 mm long, 2–2.5 mm in diameter, oblanceoloid, truncate; apical mesocarp 2 mm long, hemispheric or depressedly so, containing white, medullary membranes; basal mesocarp fibrous and fleshy.

STAMINATE PLANTS: Prostrate, stems 7–11 mm in diameter, very short; leaves 80–90 cm long, 18 mm wide at the middle and base, the subulate apex 3–4 cm long, at midsection with 24–27 parallel secondary veins in each half; staminate inflorescence almost erect, 18 cm long, fragrant; peduncle 7 cm long; flowering part 11 cm long, with conspicuous yellow bracts, the lowest one 9.5 cm long, 16 mm wide, linear

lanceolate, chartaceous, serrulate only on the short subulate tip; median bract 6 cm long, 14 mm wide, lanceolate, the margins of the outer half and the midrib below near the tip with pale, fragile serrulations 0.1 mm long; spikes about 7 and 1.5–2 cm long, 8–15 mm in diameter, dense; stamens numerous, attached singly, directly to the axis; filaments 0.1–0.2 mm long; anthers 6–7 mm long, linear, bearing at the apex a projection of the connective 0.2–0.3 mm long, sometimes subulate but more commonly flat, lanceolate, obtuse.

HOLOTYPE: Thailand, Peninsular, Krabi, 83 km. from Huay Yawt, very common in moist localities by roadside, 100 m. alt., 28 Jan. 1958, *Tem Smitinand* 4,143 (BKF).

SPECIMENS EXAMINED: Thailand, Trat, Koh Chang, shrub in evergreen forest by stream, 40 m. alt., 19 Feb. 1954, (BKF); erect shrub 40 cm. tall, common in swampy ground in evergreen forest, 1 June 1952, *Bunnak (Sang Kachand)* 333 (BKF); Trat, Huayraent, *Tem Smitinand* 1,392 (BKF); Peninsula, Trang, Kantang, Khuan nang hong, less than 100 m. alt., common in evergreen jungle, 26 Aug. 1955, *Tem Smitinand* 3,012 (BKF); S. E. Part, Trat, Kaw Kut, Ao Salat, common in evergreen forests, 5 m. alt., 5 April 1959, *Tem Smitinand* 5,702, staminate, (BKF); S. E. Part, Trat, Huang Raeng, Dong Tapit, prostrate, common in swamp by path in evergreen jungle, under 50 m. alt., 21 June 1952, *Tem Smitinand* 1,391, staminate, (BKF no. 7,276); Kasvon, Nov. 1896, *C. Curtis* 3,247 (SING).

MALAYA: Penang, near Tanjong Toking, July 1889, *C. Curtis* 1,821 (SING); Perak, Lahat, Ipoh, Oct. 1904, *H. N. Ridley*, (SING), one of the original paratypes of *P. perakensis* Ridl.

DISCUSSION: *P. Toei* is a member of the section *Acrostigma*, as is its closest relative, *P. Kingianus* Martelli of Malaya, a species which has the drupes 11–13 mm long; style 5 mm long; pileus rounded; and the leaves 40–50 cm long, 14 mm wide. *P. Toei* has the drupes 15–18 mm long; style 5–7 mm long; pileus prominently angled; and the leaves 96–130 cm long, 20 mm wide.

The new epithet is the vernacular name of the plant in its native region in Thailand.

SECTION *Microstigma**Pandanus calcis* sp. nov. (sect. *Microstigma*)

Fig. 195

NOM. VERN.: "lang kai."

DIAGNOSIS HOLOTYPI: Truncus 3 m altus ramosus eo ramisque cum "spinis brevibus armatis," foliis 75 cm longis 2–2.5 cm latis tenuibus sed subcoriaceis infra subpallidioribus supra sulcatis marginibus subrevolutis in sectione mediali cum 32 nervis secundariis in quoque latere ligulatis sed sensim in apice subulato longe diminuentibus eo 10 cm ex apice 4 mm lato basi exarmatis sed ex 4 cm marginibus cum serris fortibus arcuatis subulatis 1–2 mm longis 5–15 mm distantibus toto obscure brunneis, midnervo infra inermi, in sectione medialis marginibus cum dentibus 0.2–0.5 mm longis 6–8 mm distantibus subulatis toto adpressis ascendentibus brunneis, midnervo infra cum dentibus simulantibus 3–8 mm distantibus, circa apicem marginibus cum serris 0.2–0.3 mm longis 4–9 mm distantibus brunneis, midnervo infra cum serrulis simulantibus 13–15 mm distantibus, pedunculo 7 cm longo 7 mm diametro trigono folioso, syncarpio subgloboso 6 cm diametro terminali solitario erecto cum 26 drupis eis 3.2–3.4 cm longis 1.7–2 cm latis 1.7–1.8 cm crassis (sed in gemino 2.6 cm latis) ellipsoideis in sicco brunneis obovoideis sed basi cuneata lateribus laevibus sublucidis 5-angulatis angulis subrotundatis parte ½ supera libera, apice rotundato sed biangulatis, stigmatate 3 mm longo excentrico obdeltoideo cordato sulcato obscure brunneo papilloso valde oblique et proximo, endocarpio supramedioli osseoso obscure brunneo 12–13 mm longo lateribus 2 mm crassis, semine 6 mm longo adamantino sed trilobato, mesocarpio apicali plerumque medullosa sicco, mesocarpio basali fibroso et medullosa.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Trunk 3–5 m tall, branching, it and the branches "armed with short spines"; leaves 75–84 cm long, 2–2.7 cm wide, rather thin but subcoriaceous, slightly paler beneath, above with a central furrow and the margins gently down-rolled, at midsection with 32 secondary veins in each half, ligulate but gradually long tapering to the subulate apex which 10 cm down is 2–4 mm wide, the base unarmed for 4 cm then the mar-

gins with heavy arcuate subulate serrations 1–2 mm long, 5–15 mm apart, wholly dark brown, the nearby midrib below unarmed; at the midsection the margins with the teeth 0.2–0.5 mm long, 6–8 mm apart, subulate, fully appressed ascending, brown; the midrib below with similar teeth 3–8 mm apart; near the tip the margins with brown serrations 0.2–0.3 mm long, 4–9 mm apart, the midrib below with similar serrations 13–15 mm apart; peduncle 7 cm long, 7 mm in diameter, 3-angled, leafy bracted; lower bracts 25–33 cm long, 15 mm wide, distended and paler at base; syncarp subglobose 6–7 cm in diameter, terminal, solitary, erect, bearing 20–26 drupes, these 3.2–3.8 cm long, 1.7–2.1 cm wide, 1.7–1.8 cm thick, (but in a twinned one 2.6 cm wide), ellipsoid, when dried brown, obovoid but the base cuneate, the sides smooth, somewhat shiny, 5–6-angled, the angles more rounded than sharp, upper ½ free, the apex rounded, but two lateral angles produced into the sharp ridges curving and leading to the excentric stigma; stigma 2.5–3.5 mm long, obdeltooid cordate or oblong cordate or lance-cordate, creased, dark brown, papillose, sharply oblique and proximal; endocarp suprmedian, bony, dark brown, with two vertical columns near the center, 12–13 mm long, a narrow transverse median plate connecting to the marginal vertical flanges 2 mm thick; seed 6 mm long, diamond-shaped but with 3 ascending lobes; apical mesocarp mostly of dry, membranous pith; basal mesocarp fibrous and pithy.

HOLOTYPE: Thailand (Siam): Kao Tala, Ranawng, on limestone rocks, 200 m. alt., Feb. 3, 1927, *A. F. G. Kerr* 11,796 (BK).

SPECIMENS EXAMINED: Thailand, Kaw Wieng, Chumpawn, limestone rocks, 50 m. alt., Jan. 11, 1927, *A. F. G. Kerr* 11,373, nom. vern. "chan deng," (BK); Ban Kawp Kep, Surat, forming pure growth on top of limestone hill, 100–200 m. alt., Aug. 16, 1927, *Kerr* 13,358 (BK); Sapli, Chumpawn, Sept. 8, 1927, Put, *A. F. G. Kerr* 1,018 (BK); Kantuli, Surat, Sept. 10, 1931, Put, *A. F. G. Kerr* 4,189 (BK).

DISCUSSION: *P. calcis* is a member of the section *Microstigma*, as is its nearest relative, *P. utilissimus* Elmer, of the Philippines, a species which has the syncarp 60 cm long, 20 cm in diameter; drupes 4.5–7 cm long, linear-oblancoeloid, the sides semiviscid, the upper ½ free;

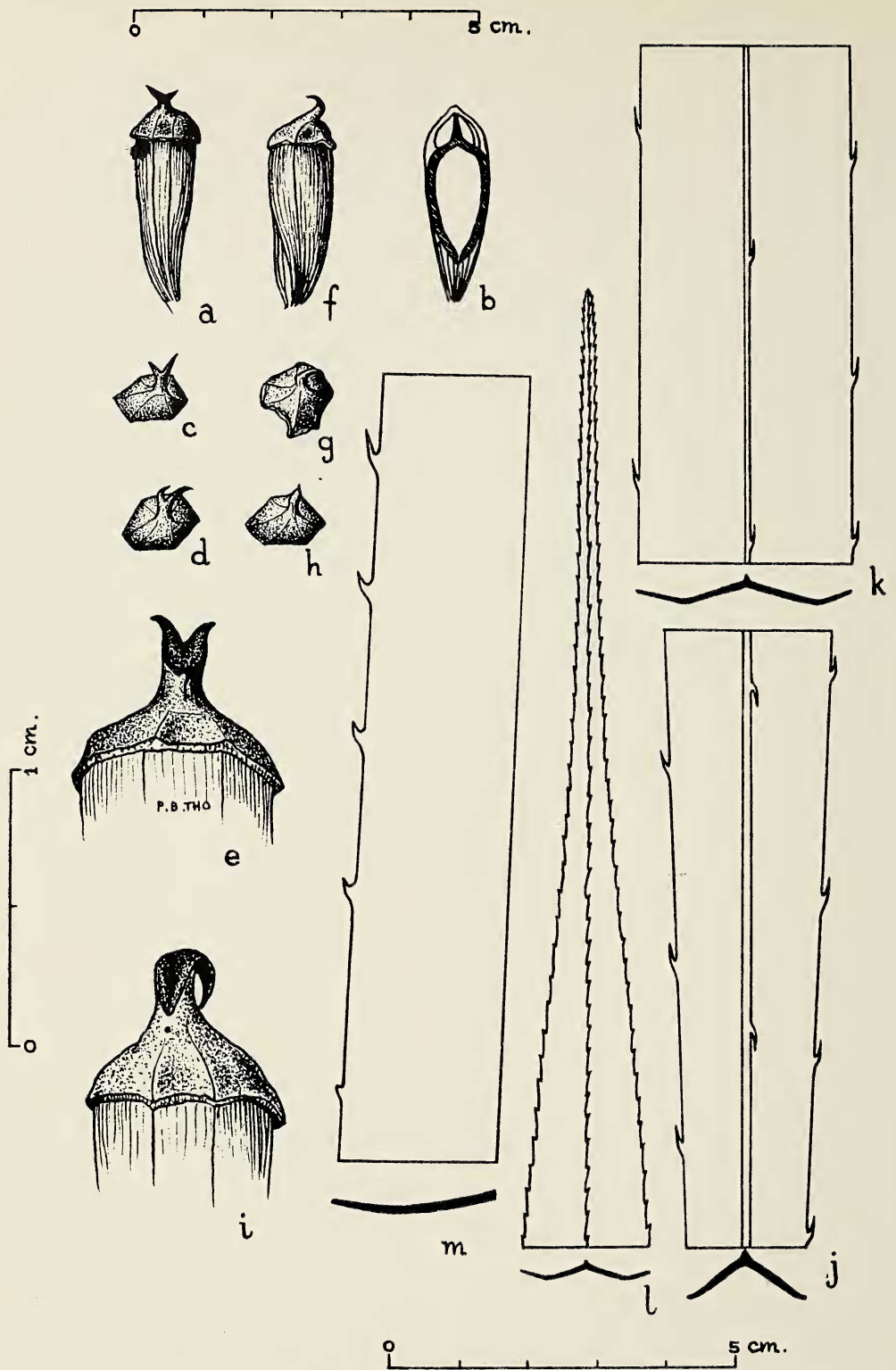


FIG. 196. *Pandanus bifidus* St. John, from holotype. *a*, Drupe, proximal view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, *d*, lateral drupes, apical view, $\times 1$; *e*, lateral drupe and stigma, proximal view, $\times 4$; *f*, apical drupe, lateral view, $\times 1$; *g*, *h*, apical drupes, apical view, $\times 1$; *i*, apex of apical drupe and stigma, oblique view, $\times 4$; *j*, leaf base, lower side, $\times 1$; *k*, leaf middle, lower side, $\times 1$; *l*, leaf apex, lower side, $\times 1$; *m*, margins of base of mature leaf, of *Kerr 20,084*, $\times 1$.

endocarp inframedian, lacking distinct marginal flanges; bark grayish, unarmed; and the leaves 5 m long, 8–20 cm wide, the apex abruptly short acuminate. *P. calcis* has the syncarp 6–7 cm in diameter, subglobose, drupes 3.2–3.8 cm long, not viscid, the upper $\frac{1}{2}$ free; endocarp supra-medial, with large lateral flanges; bark armed with short spines; and the leaves 75–84 cm long, 2–2.7 cm wide, gradually long tapering to the subulate apex.

The new epithet is from the Latin, *calx*, lime, and is given in reference to the habitat of the species, the side cliffs or summits of precipitous limestone ridges.

SECTION *Rykia*

Pandanus bifidus sp. nov. (sect. *Rykia*)

Fig. 196

NOM. VERN.: "tôi noi."

DIAGNOSIS HOLOTYPI: Planta subcaulis, foliis 1.3 m longis 3.3 cm latis subcoriaceis gladiatis in sectione mediali cum 32 nervis secundariis parallelis in quoque latere in apice subulato breve diminuentibus et 10 cm ex apice 14 mm latis proxima basem marginibus cum aculeis 3.5–4 mm longis 25–35 mm distantibus subulatis adpressi-adscendentibus stramineis, midnervo infra cum aculeis 2.5–3 mm longis 50–58 mm distantibus simulantibus sed valde reflexis, in sectio mediali marginibus et midnervo infra cum aculeis 2.5–3 mm longis 15–48 mm distantibus adscendentibus, proxima apicem marginibus et midnervo infra cum serris 0.8–1.5 mm longis 2–7 mm distantibus, syncarpio solitario terminali 12 cm longo 10 cm diametro apparente ellipsoideo cum drupis numerosis eis 3–3.2 cm longis 8–10 mm latis 8–11 mm crassis oblongo-oblancoleoidis 5–7-angulosis lateribus subplanatis, parte $\frac{1}{4}$ supera libera, pileo 4–5 mm alto semiorbiculari 5–7-anguloso sublaevi tarde deciduo, stylo 3.5–5 mm longo valido osseoso corniformato eis lateralibus proximo-curvatis irregulariter bifidis vel in eis apicalibus integris et subulatis, stigmati 3–4 mm longo brunneo papilloso proximo lanceolato vel bifido, endocarpio mediali osseoso obovoideo acuminato pallido sed intra obscure brunneo lucido lateribus 1 mm crassis, seminibus 12 mm longis obovoideis, mesocarpio apicale cavernoso, meso-

carpio basali fibroso et carnosio.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Trunk from almost none to 3 m tall; leaves 1.3–3 m long, 3.3–5 cm wide, subcoriaceous, gladiate, at midsection with 32 secondary veins in each half, tapering to a short subulate apex which 10 cm down is 14 mm wide, near the base the margins with prickles 3.5–4 mm long, 20–35 mm apart, subulate, appressed ascending, stramineous; the nearby midrib below with prickles 2.5–3 mm long, 50–58 mm apart, similar but sharply reflexed; at the middle the margins and midrib below with prickles 2.5–3 mm long, 15–48 mm apart, ascending; near the apex below finely reticulate, and the margins and midrib below with serrae 0.8–2 mm long, 2–17 mm apart; syncarp solitary, terminal, 12 cm long, 10 cm in diameter, apparently ellipsoid, bearing very numerous drupes, these 3–3.2 cm long, 8–10 mm wide, 8–11 mm thick, oblong-oblancoleoid, 5–7-angled, the sides almost plane, upper $\frac{1}{4}$ free; pileus 4–5 mm high, semi-orbicular, 5–7-angled, nearly smooth, finally deciduous; style 3.5–5 mm long, stout, bony, horn-like, the lateral ones sharply curved towards apex of syncarp, irregularly bifid, or on the apical ones entire and subulate; stigma 3–4 mm long, brown, papillose, proximal, lanceolate or bifid; endocarp median, bony, obovoid, with an apical acumination, pale except for the dark brown, shiny inner surface, the lateral walls 1 mm thick; seed 12 mm long, obovoid; apical mesocarp cavernous; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand (Siam): Pak Tong Chai, Nakawn Rachsima (=Kōrāt), marshy ground, 200 m. alt., Dec. 27, 1923, *A. F. G. Kerr* 8,132 (BK).

SPECIMENS EXAMINED: Thailand (Siam), Kao Krading, Lôi, evergreen forest, 1,200 m. alt., Feb. 11, 1931, *A. F. G. Kerr* 20,084 (BK).

DISCUSSION: *P. bifidus* St. John is a member of the section *Rykia*. Its closest relative is *P. furcatellus* Martelli from Tonkin. This has the endocarp in the lower $\frac{1}{3}$; apical mesocarp cavernous, 10–11 mm long; and the style forks ovate, acute. In contrast *P. bifidus* has the endocarp median; apical mesocarp cavernous, 4 mm long; and the style forks subulate.

The new epithet is the Latin, *bifidus*, two-left, in reference to the cleft style.

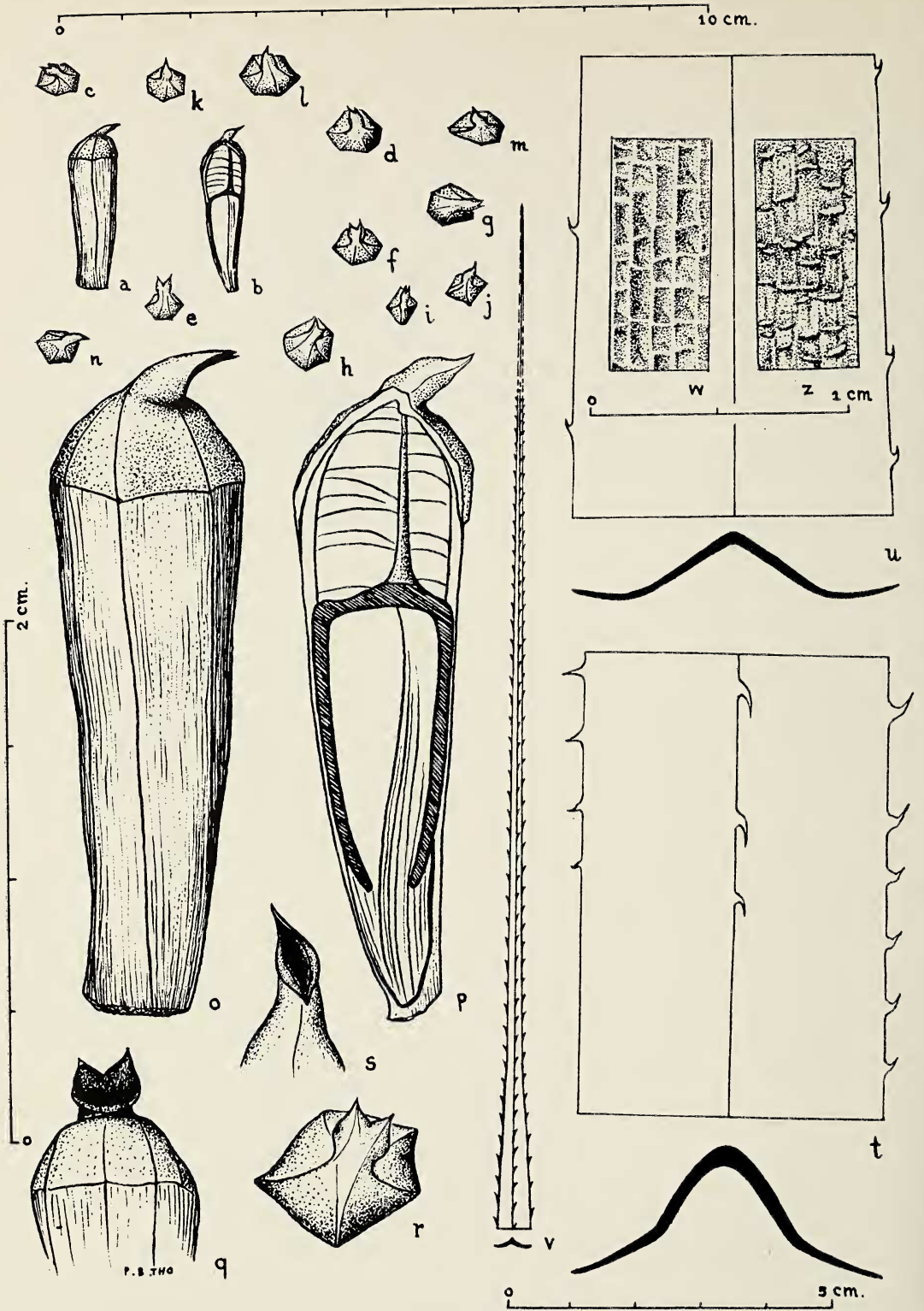


FIG. 197. *Pandanus bipollicaris* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c-j*, lateral drupes, apical view, $\times 1$; *k-n*, apical drupes, apical view, $\times 1$; *o*, drupe, lateral view, $\times 4$; *p*, drupe, longitudinal median section, $\times 4$; *q*, apex and stigma of lateral drupe, proximal view, $\times 4$; *r*, apex of lateral drupe, apical view, $\times 4$; *s*, apex and stigma of apical drupe, proximal view, $\times 4$; *t*, leaf base, lower side, $\times 1$; *u*, leaf middle, lower side, $\times 1$; *v*, leaf apex, lower side, $\times 1$; *w*, in upper third of leaf, lower side, secondary and tertiary veins, $\times 4$; *z*, in upper third, secondary and tertiary veins, upper side, $\times 4$.

Pandanus bipollicaris sp. nov. (sect. *Rykia*)

Figs. 197, 205a, b

DIAGNOSIS HOLOTYPE: Acaulescens caespitosus 80 cm diametro, foliis 2–3 m longis 4–5 cm latis supra obscure viridibus lucidisque infra viridibus vel luteo-viridibus supra sulcatis 2-plicatis in sectione mediali cum 36 nervis secundariis parallelis in quoque latere, nervis tertiis transversis multis et in sicco conspicuis et reticulis quadratis vel oblongis formantibus, laminis ligulatis sensim per 40 cm ultimas in 10 cm apice subulato trigono contractis eo circa 10 cm ex apice 2 mm lato, basi amplexicauli inermi lucida cupracea et ex 12–15 cm marginibus cum aculeis 3–6 mm longis 10–20 mm separatis crassiter subulatis subarcuato-adscedentibus stramineis vel nigris, midnervo infra ex 14–17 cm cum aculeis 4–6.5 mm longis 10–20 mm separatis crassiter subulatis arcuatis reflexis, in sectione mediali marginibus cum aculeis 2.5–3 mm longis 14–30 mm separatis arcuato-subulatis valde adscedentibus basibus incrassatis, in apice contractescentibus marginibus undulatis et cum subulato-serris 1.5–2 mm longis 1.5–5 mm separatis, midnervo infra angusto et cum serris simulantibus, in apice marginibus et midnervo infra cum serrulis 0.5–0.8 mm longis 1.5–3 mm separatis, inflorescentia foeminea terminali erecta cum syncarpio solitario, pedunculo 20 cm longo 12 mm diametro trigono folioso-bracteato, syncarpio ex bracteis tandem siccis et papyraceis subclauso, syncarpio 11.5 cm longo 6.7 cm diametro ellipsoideo subtrigono viridi cum circa 672 drupis, eis 20–25 mm longis 5–9 mm latis 4–8 mm crassis anguste cuneatis apice hemisphaerico vel pyramidal-hemisphaerico 5–7-anguloso, corpore 19–22 mm longo, basi pilei 5–6 mm alto viridi glauco, stylo 3–4 mm longo brunneo lucido osseoso proxime curvato lato compresso cornuiformi bifido lobis 0.5–2 mm longis deltoideis (raro integro), stigmatibus 1.5–2.5 mm longis late ovato-lanceolatis proximis paene ad apicem productis papillois brunneis, endocarpio in parte $\frac{1}{3}$ infera oblongo-ellipsoideo apice truncato intra pallidi lucido lateribus lateralibus 0.2 mm crassis osseosis brunneis exteriori sillonati, seminibus 7–8 mm longis 3–3.5 mm diametro, mesocarpio apicali albi medullosi in media sine fibris,

mesocarpio basali 2–3 mm longo in lateribus fibroso in media carnososo.

DIAGNOSIS OF HOLOTYPE: Stemless herb with several shoots, forming a clump 80 cm in diameter; leaves 2–3 m long, 4–5 cm wide, above dark olive green and shining, below green to yellowish green, above with V-shaped furrow over the midrib and two lateral pleats, at midsection with 36 secondary parallel veins in each half, tertiary cross veins numerous and visible, but on drying conspicuous, forming squarish or oblong meshes, blade ligulate, gradually contracted in the last 40 cm to a 10 cm subulate, trigonous apex, this about 10 cm down 2 mm wide, the base amplexicaul, unarmed, shining, dull copper-colored, beginning at 12–15 cm the margins with spines 3–6 mm long, 10–20 mm apart, thick subulate, slightly upcurved, stramineous to blackish; the midrib below beginning at 14–17 cm with spines 4–6.5 mm long, 10–20 mm apart, heavy subulate, arcuate, reflexed; at midsection the margins with prickles 2.5–3 mm long, 14–30 mm apart, arcuate subulate from a thickened base, strongly ascending; the midrib below unarmed; in the contracting part near the tip the margins undulate and with subulate-serrae 1.5–2 mm long, 1.5–5 mm apart; the narrow midrib below with similar serrae; on the apex the margins and midrib below with serrulations 0.5–0.8 mm long, 1.5–3 mm apart; pistillate inflorescence terminal, erect, bearing one syncarp; peduncle 20 cm long, 12 mm in diameter, 3-sided, leafy bracted; syncarp surrounded and nearly hidden by bracts that become dry and papery; syncarp immature but apparently about full sized, 11.5 cm long, 6.7 cm in diameter, ellipsoid, slightly 3-sided, green, bearing about 672 drupes, these 20–25 mm long, 5–9 mm wide, 4–8 mm thick, narrowly cuneate, the apex hemispheric or pyramidal-hemispheric, 5–7-angled, the body 19–22 mm long; pileus with its base 5–6 mm high hemispheric or pyramidal-hemispheric, green, glaucous (immature); style 3–4 mm long, brown, shining, bony, proximally curved, broad, flattened hornlike, equally or unequally bifid, the lobes 0.5–2 mm long, deltoid (rarely unbranched this mostly on terminal drupes); stigmas 1.5–2.5 mm long, broadly ovate-lanceolate, proximal, following each lobe almost to the tip, papillose, brown; endocarp in lower $\frac{1}{3}$, oblong-ellipsoid, the apex

truncate, the inner surface pale, shining, the walls 0.2 mm thick, bony, brown, and the outer surface with sharp longitudinal ridges; seed 7–8 mm long, 3–3.5 mm in diameter; apical mesocarp of white pith, without fibers except up the sides; basal mesocarp 2–3 mm long, fibrous up the sides, fleshy within.

HOLOTYPE: Vietnam, Bach Ma, Province de Thua-Thiên, on forested stream bank, 1,400 m. alt., Jan. 26, 1961, *H. St. John 26,379* (BISH).

DISCUSSION: *P. bipollicaris* is a member of the section *Rykia*, as is its closest relative, *P. bicornis* Ridl. of Malaya, a species which has the peduncle 5–10 cm long; syncarp 7–8 cm long, 5.6 cm in diameter, bearing 100–120 drupes, these 28–34 mm long, 8–10 mm wide; style 2–3 mm long; endocarp central, with a central apical prolongation, the lateral walls 2 mm thick; leaves 0.7–2 m long, at midsection with 24 secondary veins in each half, the blade quickly tapering into a 5 cm subulate apex, and near the base the margins with prickles 2.5–4 mm long and 2–7 mm apart. *P. bipollicaris* has the peduncle 20 cm long; syncarp 11.5 cm long, 6.7 or more cm in diameter, bearing about 672 drupes, these 20–25 mm long, 5–9 mm wide; style 3–4 mm long; endocarp in lower $\frac{1}{3}$, the apex truncate, the lateral walls 0.2 mm thick; leaves 2–3 m long, at midsection with 36 secondary veins on each side, very gradually tapering into a 10 cm subulate apex, the margins near the base with spines 3–6 mm long, 10–20 mm apart.

The epithet is the Latin adjective, *bipollicaris*, length of two thumbs or two inches, and is chosen with reference to the leaves which are about two inches wide.

Pandanus magnifibrosus sp. nov. (sect. *Rykia*)

Fig. 198

DIAGNOSIS HOLOTYPEI: Planta sine caule, foliis "3.65 m. longis," 4.8 cm latis coriaceis ligulatis in sectione mediali cum 34 nervis secundariis in quoque latere in apice subulato longe diminuentibus et 10 cm ex apice solum 16 mm latis trinerbatis et in sectione M-formatis, in regione mediali marginibus cum aculeis 2–2.2 mm longis 8–15 mm distantibus arcuato-subulatis subluteis, midnervo infra cum aculeis 2–2.5 mm longis 9–17 mm distantibus salientibus sed api-

cibus reflexis, proxima apicem marginibus et midnervo infra cum serris 0.5–0.8 mm longis 1–4 mm distantibus et nervulis secundariis supra cum serris simulantibus 3–8 mm distantibus, "pedunculo 0.38 m. longo, syncarpio 0.34 m. ambitu," drupis numerosissimis 27–30 mm longis 3–4 mm latis et crassis anguste oblanceo-fusiformibus 5–6-angulatis, parte $\frac{3}{7}$ supera libera, pileo 12–13 mm longo arcuato lineari-lanceoloideo firmo papilloso rugosoque stramineo, stylo 5–6 mm longo subulato arcuato ad apicem vel ad basem syncarpium cartilagineo laevi et lucido, stigmatibus 6–7 mm longo sublineari brunneo papilloso proximo, endocarpio in parte $\frac{2}{3}$ infera et 12 mm longo pallido, seminibus non evidentibus forsitan sterilibus, mesocarpio apicali et laterali conjunctis valde fibrosis et medullosis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Stemless; leaves "3.65 m. long," 4.8 cm wide, coriaceous, ligulate, at midsection with 34 secondary veins in each half, long tapering to a heavy subulate apex which 10 cm down is 16 mm wide; the base not seen; 3-nerved and in section M-shaped; at the middle the margins with prickles 2–2.2 mm long, 8–15 mm apart, arcuate-subulate, yellowish; the nearby midrib below with prickles 2–2.5 mm long, 9–17 mm apart, salient but the apex reflexed; near the apex the margins and midrib below with serrae 0.5–0.8 mm long, 1–4 mm apart, and the secondary nerves above with similar serrae 3–8 mm apart; "peduncle 0.38 m. long; syncarp 0.34 m. in circumference"; drupes very numerous, 27–30 mm long, 3–4 mm wide and thick, narrowly oblance-fusiform, 5–6-angled, the upper $\frac{3}{7}$ free; pileus 12–13 mm long, arcuate linear-lanceoloid, firm papillose and rugose, stramineous; style 5–6 mm long, subulate, curved and often recurved, cartilaginous, smooth and shining; stigma 6–7 mm long, almost linear, brown papillose, proximal; endocarp in lower $\frac{2}{3}$ and 12 mm long, pale; seeds not seen, perhaps sterile, though apparently mature; apical and lateral mesocarp continuous, strongly fibrous and pithy; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand (Siam), Kao Soi Dao, Patalung, evergreen forest, 300 m. alt., April 29, 1930, *A. F. G. Kerr 19,227* (BK).

DISCUSSION: *Pandanus magnifibrosus* St. John is a member of the section *Rykia*. Its closest

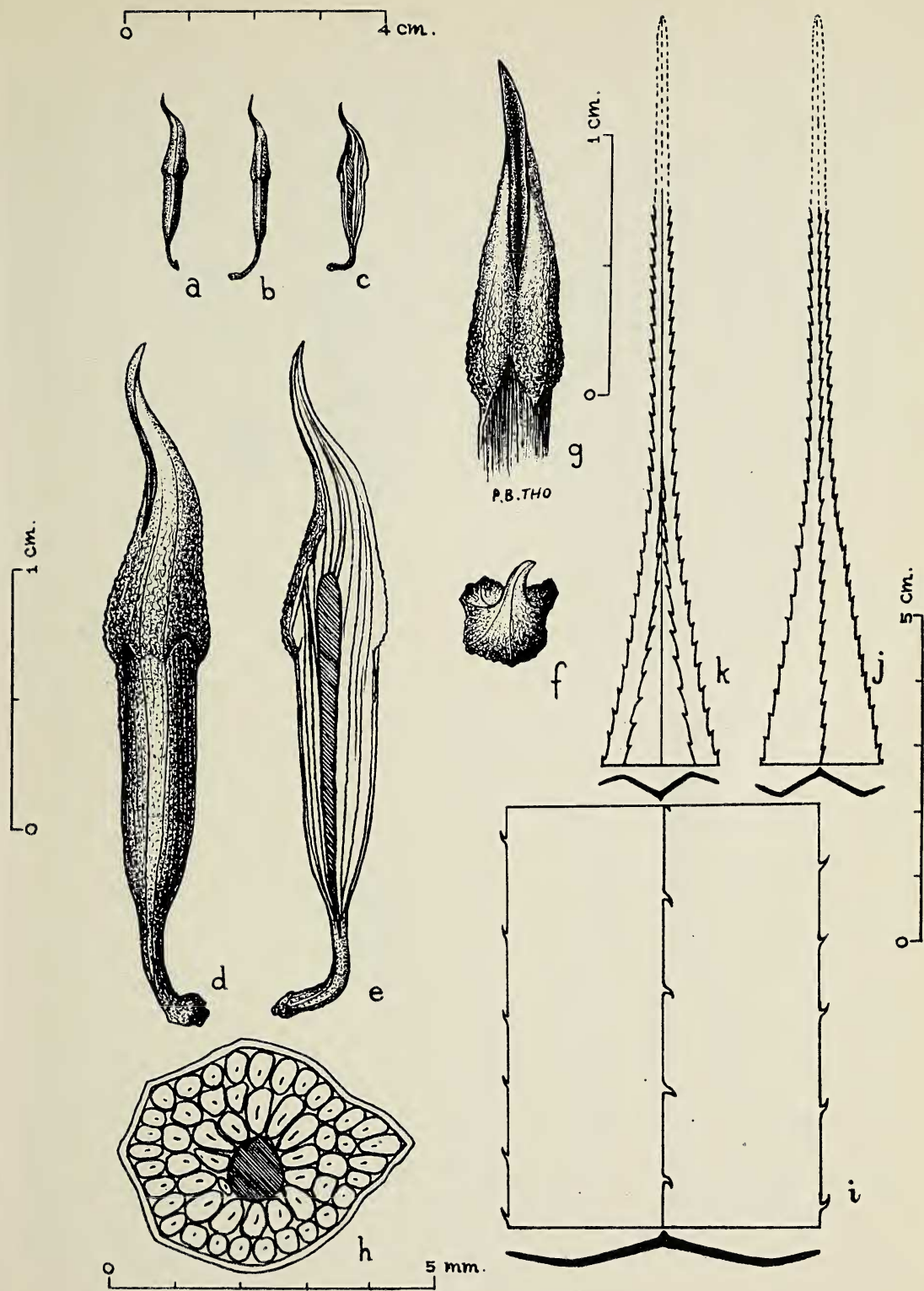


FIG. 198. *Pandanus magnifibrosus* St. John, from holotype. *a, b*, Drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, apical view, $\times 4$; *g*, drupe apex and stigma, proximal view, $\times 4$; *h*, drupe, median transverse section, $\times 10$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$; *k*, leaf apex, upper side, $\times 1$.

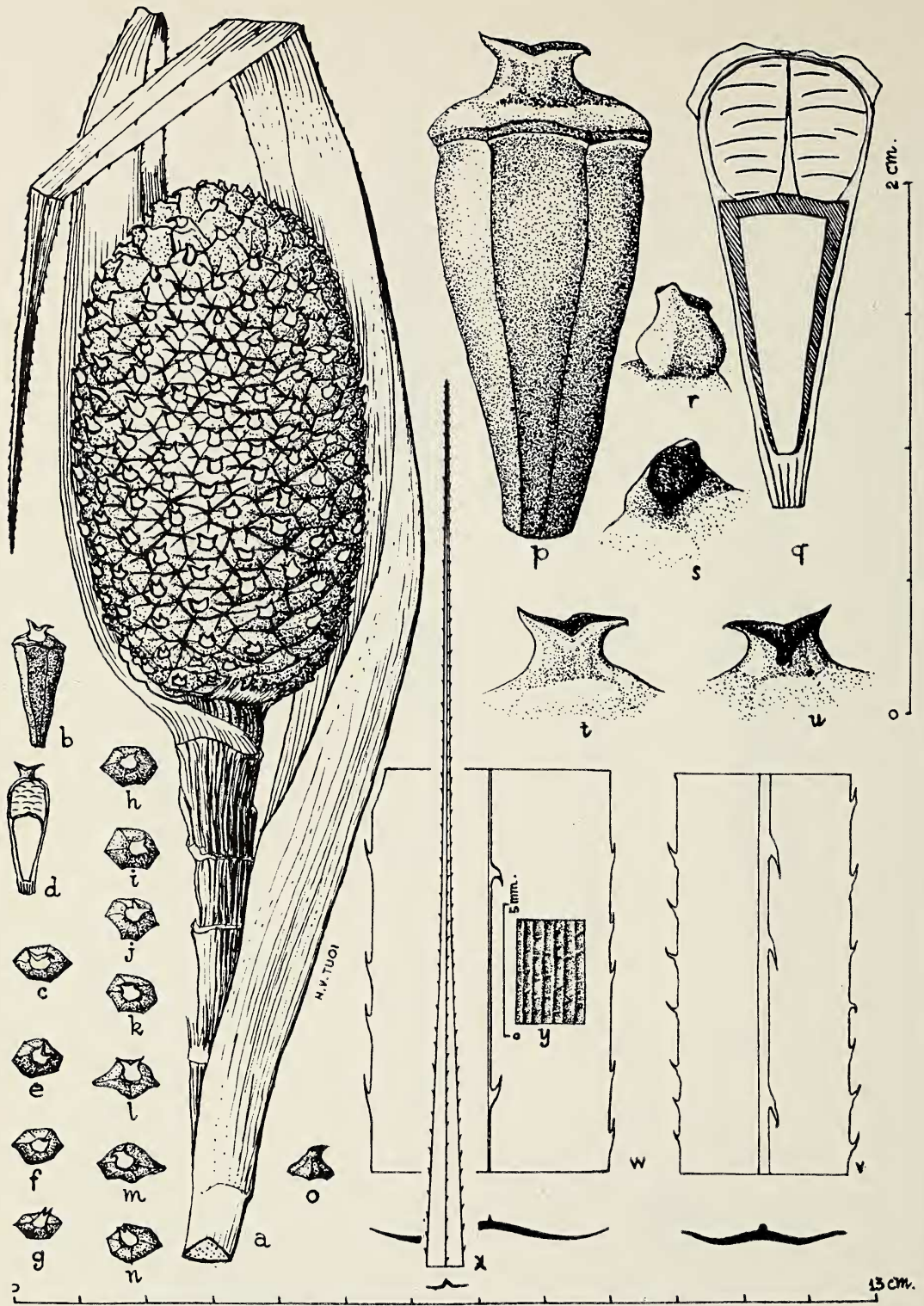


FIG. 199. *Pandanus obconicus* St. John, from the holotype. *a*, Syncarp and bracts, $\times 1$; *b*, drupe, distal view, $\times 1$; *c*, drupe, apical view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e-n*, lateral drupes, apical view, $\times 1$; *o*, apical drupe, lateral view, $\times 1$; *p*, drupe, proximal view, $\times 4$; *q*, drupe, longitudinal median section, $\times 4$; *r*, apex of apical drupe and stigma, distal view, $\times 4$; *s*, stigma of apical drupe, proximal view, $\times 4$; *t*, apex of lateral drupe, distal view, $\times 4$; *u*, apex of lateral drupe and stigma, proximal view, $\times 4$; *v*, leaf base, lower side, $\times 1$; *w*, leaf middle, lower side, $\times 1$; *x*, leaf apex, lower side, $\times 1$; *y*, lower side of leaf in outer third, with secondary and tertiary veins, $\times 4$.

relative is *P. Sarasinorum* Warb. of the Celebes and Minhassa, a species having the syncarps 3.5 cm in diameter, racemose; drupes 12–14 mm long, 2 mm in diameter; style 4 mm long; and the leaf spines becoming black. In contrast, *P. magnifibrosus* has the syncarps 11.3 cm in diameter, solitary; drupes 27–30 mm long, 3–4 mm in diameter; style 5–6 mm long; and the leaf spines yellowish.

The new epithet is from the Latin, *magnus*, large, *fibrosus*, with fibers, in allusion to the very large, longitudinal fibers in the drupes.

Pandanus obconicus sp. nov. (sect. *Rykia*)

Fig. 199

DIAGNOSIS HOLOTYPI: Planta acaulescens, foliis 96 cm longis in media 3.6 cm latis proxima basem 2.7 cm latis coriaceis late sulcatis 2-plicatis in sectione mediali M-formatis et cum 37–39 nervis secundariis parallelis in quoque dimidio nervis tertiis ad basem et ad apicem conspicuis et reticulos breviter oblongos formantibus laminis gladiformatis et in apice 8–12 cm longo trigono subulato eo 10 cm ex apice 3 mm lato basi amplexicauli et inermi sed ex 5–13 cm marginibus cum aculeis 2.5–5 mm longis 7–15 mm separatis crassiter arcuatis subulatis stramineis adscendentibus, midnervo infra ex 8–15 cm cum aculeis 5–6 mm longis 12–25 mm separatis subulatis subcurvatis valde reflexis in sectione mediali marginibus cum aculeis 2–3 mm longis 6–9 mm separatis crasse subulatis adpresse adscendentibus, midnervo infra cum aculeis 3–4 mm longis remotis subulatis arcuatis basi incrassati reflexis vel adscendentibus, in apice subulato marginibus cum serris 0.5–1 mm longis 2–4 mm separatis, midnervo infra cum aculeis simulantibus 4–6 mm separatis, infructescencia terminali erecta cum syncarpio unico, pedunculo 17 cm longo 1 cm diametro trigono folioso-bracteato, bracteis superis 9–10 cm longis 4 cm latis minute serrulatis dentibus 0.2 mm longis, syncarpio 7.5 cm longo 4.5 cm diametro ellipsoideo cum circa 496 drupis eis 16–19 mm longis 7–9 mm latis 4–7 mm crassis eis terminalibus majoribus crassiter cuneiformis compressis 5–7-angulatis parte $\frac{1}{6}$ supera libera corpore 14–17 mm longo lateribus planis, pileo 3–4 mm alto basi depresso obtuso 5–7-anguloso minute papilloso, stylo 2–3 mm longo osseoso

brunneo lucido compresso proxime curvato $\frac{2}{5}$ (vel $\frac{1}{3}$ – $\frac{1}{2}$) bifido lobis plerumque divergentibus, stigmatibus 1.5–2 mm longis apicalibus vel in parte proximalibus brunneis papillosis, endocarpio infra mediali osseoso pallide brunneo lateribus 0.6–0.7 mm crassis intra obscure brunneis lucidis apice cum acumine fragili, semine 7 mm longo anguste obconico, mesocarpio apicali grandi cavernoso cum membranis medullosis albis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Plant acaulescent; leaves 96 cm long, 3.6 cm wide at the middle, 2.7 cm wide near the base, coriaceous, broadly furrowed above the midrib, 2-pleated, in section M-shaped, at midsection with 37–39 parallel secondary veins in each half, the tertiary cross veins marked near the base and the tip, forming short oblongs, and from these the outer third of the blade has a reticulate appearance, the blade sword-shaped, narrowed to an 8–12 cm trigonous subulate apex which 10 cm down is 3 mm wide, the base amplexicaul, unarmed, but beginning at 5–13 cm the margins with prickles 2.5–5 mm long, 7–15 mm apart, stout arcuate subulate, ascending, stramineous; the midrib below beginning at 8–15 cm with prickles 5–6 mm long, 12–25 mm apart, subulate, slightly curved, sharply reflexed; at the midsection the margins with prickles 2–3 mm long, 6–9 mm apart, stout subulate, appressed ascending; the midrib below with remote prickles 3–4 mm long, subulate, arcuate, with an incrassate base, reflexed or ascending as here the change-over occurs; on the subulate apex the margins with serrations 0.5–1 mm long, 2–4 mm apart; those of the midrib similar but 4–6 mm apart; infructescence terminal, erect, bearing one syncarp; peduncle 17 cm long, 1 cm in diameter, trigonous, leafy bracted, the upper bracts 9–10 cm long, 4 cm wide, minutely serrulate, the teeth 0.2 mm long; syncarp 7.5 cm long, 4.5 cm in diameter, ellipsoid, bearing about 496 drupes, these 16–19 mm long, 7–9 mm wide, 4–7 mm thick, the apical ones perceptibly the larger, thick cuneiform, compressed, 5–7-angled, upper $\frac{1}{6}$ free, the body 14–17 mm long, the sides flat; pileus 3–4 mm high, the base low obtuse, 5–7-angled, minutely papillose; style 2–3 mm long, bony, brown, shining, flattened, curved proximally, bifid usually $\frac{2}{5}$ way, rarely $\frac{1}{3}$ or $\frac{1}{2}$ way, the lobes usually divergent; stigma 1.5–2 mm long,

on the apex or partly on the proximal side of each lobe, brown, papillose; endocarp submedian, bony, pale brown, the lateral walls 0.6–0.7 mm thick, the inside surface dark brown, shiny, crowned by a weak apical acumination; seed 7 mm long, narrowly obconic; apical mesocarp a large cavern divided by white medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand, s. e. part, Chaburi, Makham, 100 m. alt., common along edge of savannah in scrub forest, 13 Jan. 1958, *Tem Smitinand 4,054* (SING).

DISCUSSION: *P. obconicus* is a member of the section *Rykia*, as is its closest relative, *P. horizontalis* St. John, of Vietnam, a species with peduncle 45 cm long; syncarp 10.5 cm long, 7–8 cm in diameter, with about 720 drupes, these 26–31 mm long, 9–11 mm wide; pileus base high rounded conic; endocarp in lower $\frac{1}{3}$; seed 12 mm long; stem 1.5 m tall; leaves 2.7 m long, at midsection with 33 secondary veins in each half, and near the base the midrib below with thorns 3–4 mm long, 17–35 mm apart. *P. obconicus* has the peduncle 17 cm long; syncarp 7.5 cm long, 4.5 cm in diameter, with about 496 drupes, these 16–19 mm long, 7–9 mm wide; pileus base low obtuse; endocarp submedian; seed 7 mm long; acaulescent; leaves 96 cm long, at midsection with 37–39 secondary veins in each half, and near the base the midrib below with prickles 5–6 mm long, 12–25 mm apart.

The new epithet is Latin, *ob*, inversed, *conicus*, conical, given in reference to the obconic shape of the endocarp.

Pandanus obovatus sp. nov. (sect. *Rykia*)

Fig. 200

DIAGNOSIS HOLOTYPEI: Arbor "6 m. alta ramosa, trunco cum spinis parvis," foliis 1.1 m plus longis 3.1 cm latis subcoriaceis in sectione mediali cum 39 nervis secundariis in quoque dimidio gradatim ad apicem longe diminuentibus supra secundum midnervum canaliculatis marginibus reflexis, basi integra amplexicaulique sed ex 5–7 cm marginibus cum aculeis pallidis 2–2.5 mm longis 5–9 mm distantibus subulatis adscendentibus, midnervo infra per 15 cm inermi deinde cum aculeis reflexis 0.5–1 mm longis 15–18 mm distantibus subulatis, in sectione mediali marginibus cum aculeis 0.8–0.9

mm longis 7–10 mm distantibus subulatis adscendentibus, midnervo infra cum aculeis 0.3–0.5 mm longis 8–18 mm distantibus simulantibus adscendentibus, ad apicem marginibus midnervoque infra cum serrulis 0.2 mm longis 5–15 mm distantibus, syncarpio "cum 15–18 carpelis," drupis 7.5–8.3 cm longis 4.9 cm latis 3.7 cm crassis obovoideis deltoideis laevissimis, lateribus superis laevibus brunneo-lucidis quasi ceratis et pallide multirimosis deltoideis, parte $\frac{1}{3}$ supera libera, parte $\frac{1}{2}$ infera pallide brunnea et cum dorsis et valleculis angustis longitudinalibus interobseratis, apice rotundato sed cum dorsis duobis ad stigmatem connectis, stylo corniculato compresso divergente, stigmatem 8 mm longo late obovato exsulcato subverticale brunneo, endocarpio submediali parte centrali 4.3 cm longa osseosa obscure brunnea ellipsoidea muris lateralibus 2–3 mm crassis et cum humeris fortibus pallidis lateralibus submediale affixis eis oris 3.5–4.5 cm longis marginalibus crassis, semine unico 25 mm longo 9 mm diametro ellipsoideo mesocarpio laterali apicalique continuo sicco et meduloso sed cum fibris longitudinalibus, mesocarpio basali dimidio supero simulanti, dimidio infero fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree "6 m. tall, branching; stem with small spines"; leaves more than 1.1 m long, 3.1 cm wide, subcoriaceous, at midsection with 39 secondary veins in each half, gradually long tapering towards the apex, (the tip missing in ours), channeled above the midrib, the margins reflexing, the base amplexicaul and entire, but beginning 5–7 cm up the margins with pale prickles 2–2.5 mm long, 5–9 mm apart, subulate, ascending; the midrib below unarmed for 15 cm, then with reflexed prickles 0.5–1 mm long, 15–18 mm apart, subulate; at midsection the margins with prickles 0.8–0.9 mm long, 7–10 mm apart, subulate, ascending; the midrib below with similar appressed ascending prickles 0.3–0.5 mm long, 8–18 mm apart; towards the apex the margins and midrib below with serrations 0.2 mm long, 5–15 mm apart; syncarp "with 15–18 carpels"; drupes 7.5–8.3 cm long, 4.9 cm wide, 3.7 cm thick, obovoid, 3-sided, very light, the upper sides smooth, brown and shiny as if varnished and with many pale longitudinal cracks, 3-angled, upper $\frac{1}{3}$ free, lower half pale brown and with several sharp longitudinal ridges and

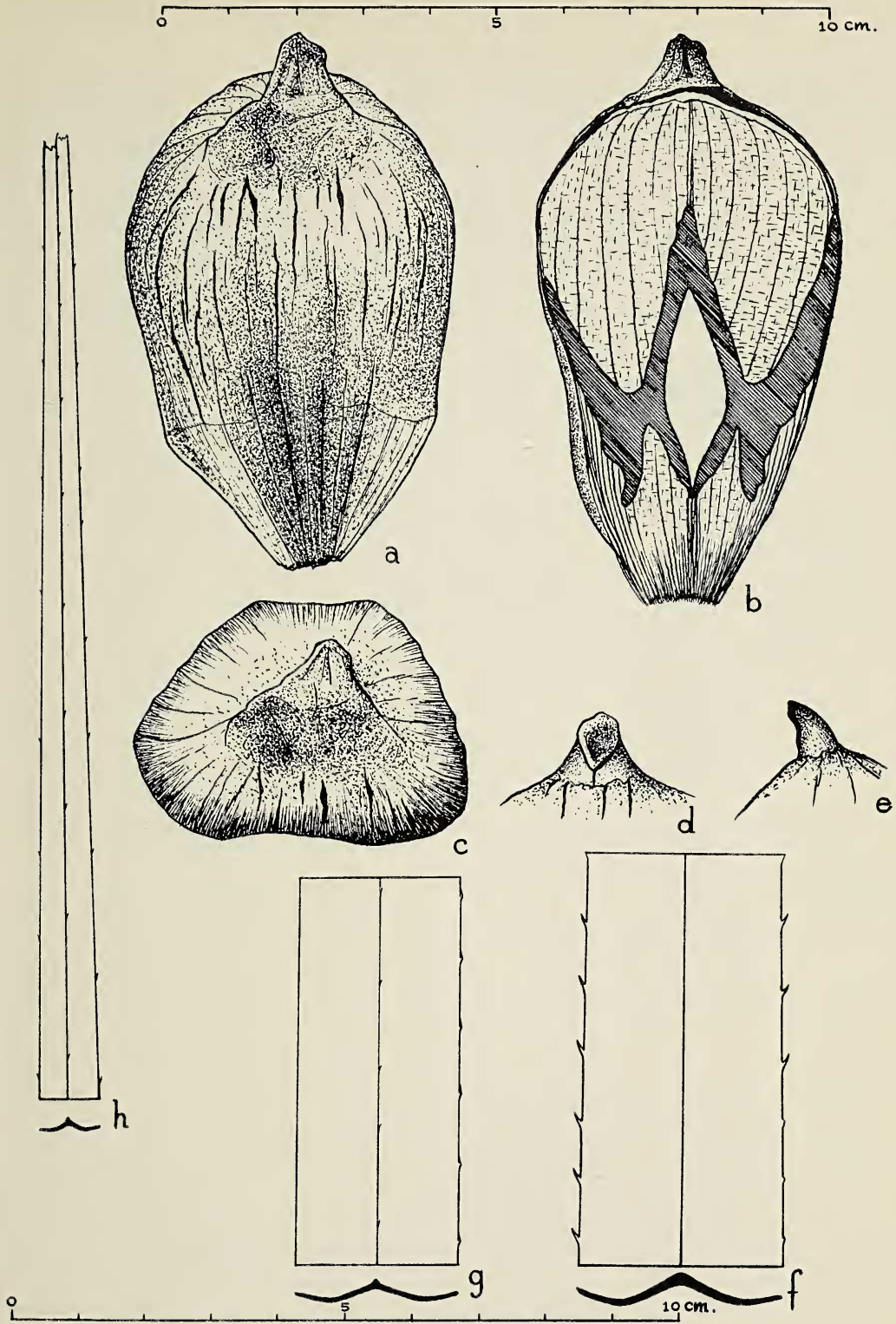


FIG. 200. *Pandanus obovatus* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c*, drupe, apical view, $\times 1$; *d*, stigma, proximal view, $\times 1$; *e*, apex of drupe, lateral view, $\times 1$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

valleys like mortising angles, the apex rounded but from each of two angles a ridge mounts to support the stigma on a flattened, overhanging process or style; stigma 8 mm long, broadly obovate, without crease, nearly vertical, brown; endocarp submedian, the central part 4.3 cm long, bony, dark brown, and ellipsoid, its lateral walls 2–3 mm thick, a little below the middle of this central endocarp are heavy, pale, lateral shoulders bearing heavy marginal flanges 3.5–4.5 cm long; seed solitary, 25 mm long, 9 mm in diameter, ellipsoid; lateral and apical mesocarp continuous, dry and pithy but with longitudinal fibers, and this pithy mesocarp also occupies the upper half of the area below the endocarp, the remaining basal area fibrous and fleshy.

HOLOTYPE: Thailand (Siam): Mënam Pasak, Keng Koi, on rocky limestone hill, Dec. 9, 1923, A. F. G. Kerr 7,669 (BK).

DISCUSSION: *P. obovatus* is a member of the section *Rykia*, though with its large, dry, pithy drupes it is unique and without a close relative. It can be compared to *P. borneensis* Warb. which has the syncarps spicate, 6–8 cm long; drupe apex 10–12 mm broad; and the style 2 mm long. In *P. obovatus* the syncarp is solitary, about 23 cm long; drupe apex 4.9 cm broad; and the style 11 mm long, horn-like, flattened.

The type specimen consists of a leaf minus the tip, and three fruit halves, yet so unique is the species that this much suffices. There are no really close relatives known.

The new epithet is the Latin *obovatus*, referring to the obovate profile of the drupes.

Pandanus reticulosus sp. nov. (sect. *Rykia*)

Fig. 201

NOM. VERN.: "toei yai" (= *Pandanus* big).

DIAGNOSIS HOLOTYPI: Licet acaulescens, foliis 2 m longis 5 cm latis in medio 3.8 cm latis circa basem coriaceis reticulatis in sectione mediale cum 33 nervis secundariis parallelis fortibus in quoque dimidio, nervis tertiis transversis fortibus elevatis et reticulam quadratorum vel oblongorum brevium formantibus, laminis ligulatis sed subabrupte in apice circa 10 cm longo caudato trigono subulato diminuentibus eo circa 10 cm ex apice 5 mm lato, basi amplexicauli et inermi pallida sed ex 7–15 cm marginibus cum aculeis

3–5 mm longis 12–22 mm separatis subulatis curvatis fortibus pallidis adscendentibus, midnervo infra ex 12.5 cm cum aculeis 3–6 mm longis 32–65 mm separatis arcuato-subulatis reflexis, in sectione mediali marginibus cum aculeis 2.8–3 mm longis 14–24 mm separatis arcuatis subulatis adscendentibus, midnervo infra inermi, in apice subulato marginibus cum serrulis 0.6–1 mm longis 1–3 mm separatis, midnervo infra cum serrulis 0.3–0.8 mm longis 3–4 mm separatis, pedunculo "brevi," syncarpio solitario 7 cm longo 5.5 cm diametro latiter ellipsoideo purpurascenti cum 113 drupis, eis 22–26 mm longis 9–14 mm latis 9–11 mm crassis oblanceoloideis basi truncata 6-angulosis parte ¼ supera libera, corpore 18–22 mm longo lateribus planis, pileo 6–8 mm alto basi 4–5 mm alto semiorbiculari vel depresso semiorbiculari rugosa exlaevi minime 6-angulosa, stylo 2.5–5 mm longo osseoso brunneo lucido compresso proxime curvato eis druparum lateralium plerumque breviter bifidis sed aliquis basalibus subulatis, stigmatibus 1–1.5 mm longo cordato vel late cordato brunneo papilloso in apice proximali cavernoso affixi, endocarpio mediali 11 mm longo osseoso extus pallidi lateribus 0.8 mm crassis intra obscure brunneis et lucidis, seminibus 10 mm longis 8 mm diametro obovoideis, mesocarpio apicali aerenchymati cum membranibus latis transversis albis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Apparently acaulescent, gregarious on ground among undershrubs; leaves 2 m long, 5 cm wide at the middle, 3.8 cm wide near the base, coriaceous, reticulately veined and conspicuously so in outer half, at midsection with 33 parallel secondary veins in each half, the tertiary cross veins heavy, raised, forming a reticulum of squares or short oblongs, blade ligulate, rather abruptly narrowed to a caudate trigonous subulate apex about 10 cm long, this about 10 cm down 5 mm wide, the base amplexicaul and unarmed, pale, but beginning 7–15 cm up the margins with spines 3–5 mm long, 12–22 mm apart, stout curved subulate, ascending, pale; the midrib below beginning at 12.5 cm with spines 3–6 mm long, 32–65 mm apart, arcuate subulate, reflexed; at midsection the margins with prickles 2.8–3 mm long, 14–24 mm apart, arcuate subulate, ascend-

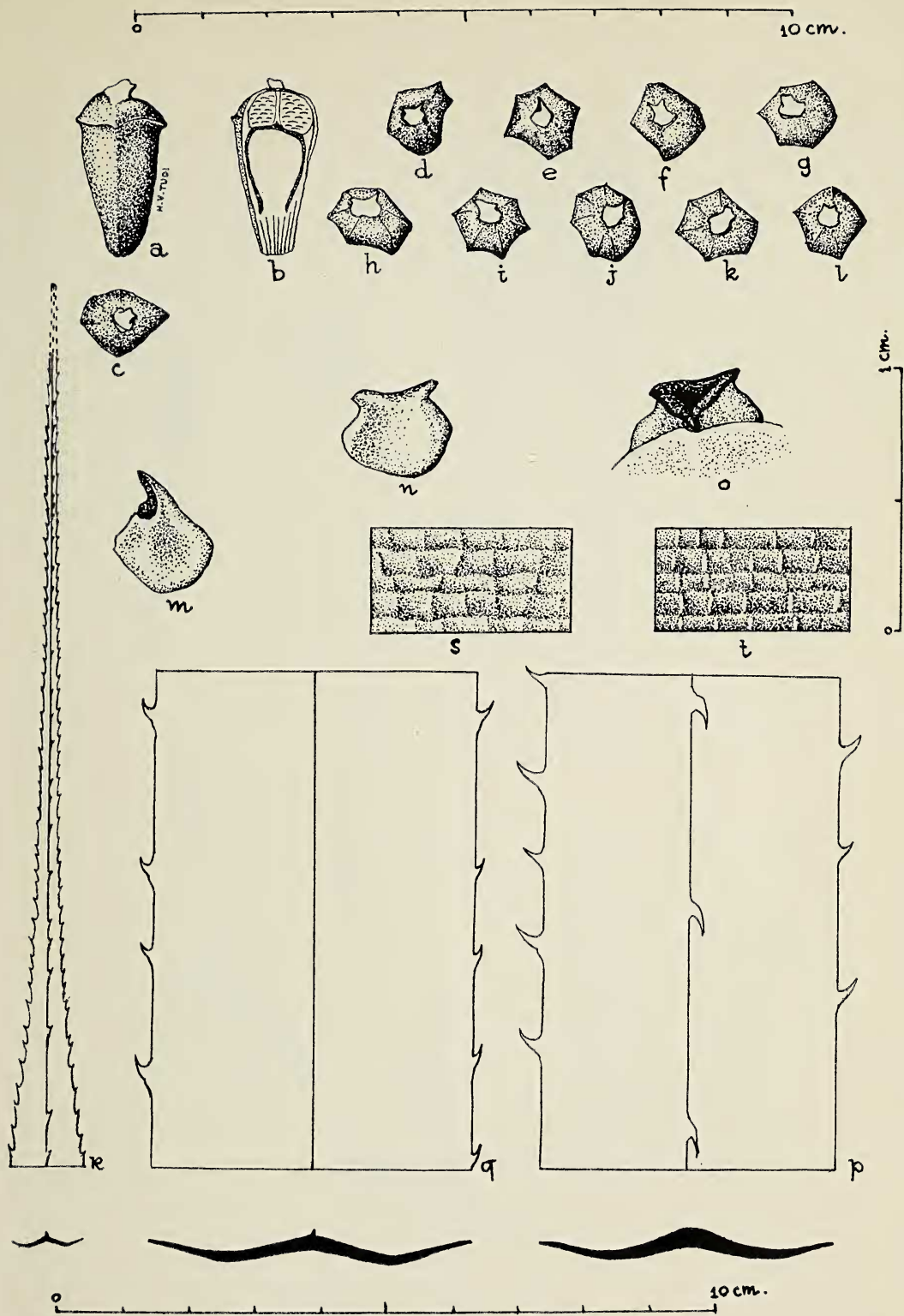


FIG. 201. *Pandanus reticulosus* St. John, from holotype. *a*, Drupe, lateral view, $\times 1$; *b*, drupe, longitudinal median section, $\times 1$; *c-l*, drupe, apical view, $\times 1$; (*d* and *f* are the most common kinds; *e* is basal, rarely lateral); *m*, apex of apical drupe and stigma, lateral view, $\times 4$; *n*, apex of lateral drupe, oblique view, $\times 4$; *o*, apex of lateral drupe and stigma, proximal view, $\times 4$; *p*, leaf base, lower side, $\times 1$; *q*, leaf middle, lower side, $\times 1$; *r*, leaf apex, lower side, $\times 1$; *s*, leaf middle, upper side, secondary and tertiary veins, $\times 4$; *t*, leaf middle, lower side, secondary and tertiary veins, $\times 4$.

ing; the midrib below unarmed; on the subulate apex the margins with serrations 0.6–1 mm long, 1–3 mm apart; the midrib below with serrations 0.3–0.8 mm long, 3–4 mm apart; peduncle "short"; syncarp single, 7 cm long, 5.5 cm in diameter, broadly ellipsoid, purplish, bearing 113 drupes, these 22–26 mm long, 9–14 mm wide, 9–11 mm thick, oblanceoloid from a truncate base, 6-angled, upper $\frac{1}{4}$ free, the body 18–22 mm long, with flat sides; pileus 6–8 mm high, its base 4–5 mm high, semiorbicular or oblately so, the surface roughened, dull, weakly 6-angled; style 2.5–5 mm long, bony, brown, shining, flattened, proximally curved, the lateral ones mostly shortly bifid, but some of the basal ones with a single, subulate tip; stigma 1–1.5 mm long, cordate or broadly so, brown, papillose, in the hollow proximal tip; endocarp median, 11 mm long, bony, pale without, the walls 0.8 mm thick, within dark brown and shining; seed 10 mm long, 8 mm in diameter, obovoid; apical mesocarp an aerenchyma with broad transverse, white membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand, n. e. region, Loei, Phu Krading, Tham Saw, common in evergreen forest, 1,300 m. alt., *Tem Smitinand* 406 (BKF no. 11,999).

DISCUSSION: *P. reticulosus* is a member of the section *Rykia*, as is its closest relative, *P. bicornis* Ridl. of Malaya, a species which has the syncarp 15 cm long; drupes 34 mm long; style forks spreading and with the tips recurved; seed 6 mm long, cylindric; and the leaf margin near the base with spines 2.5–4 mm long, and 2–7 mm apart. *P. reticulosus* has the syncarp 7 cm long; drupes 22–26 mm long; style forks ascending or diverging; seed 10 mm long, obovoid; and the leaf margin near the base with spines 3–5 mm long, and 12–22 mm apart.

The new epithet is the Latin adjective, *reticulosus*, with a network, and is given in reference to the reticulate venation of the leaves.

Pandanus thailandicus sp. nov. (sect. *Rykia*)

Figs. 202, 203

NOM. VERN.: "toei nām."

DIAGNOSIS HOLOTYPE: Frutex 1.5 m altus ramosus, foliis 35–37 cm longis 6–8 mm latis subcoriaceis ligulatis planatis vel marginibus

paene involutis in sectione mediali cum 13 nervis secundariis parallelis in quoque dimidio parte $\frac{1}{3}$ supera sensim in apice subulato diminuenti 10 cm ex apice 4 mm lata in sicco pallidis et infra subglaucis in basi amplexicaulibus et integris proxima basem marginibus cum aculeis 1.8–2.2 mm longis 8–15 mm separatis adscendentibus arcuato-subulatis stramineis, midnervo infra cum aculeis 2.2–2.5 mm longis 8–25 mm distantibus simulantibus adscendentibus, in sectione mediali marginibus cum aculeis 1.3–1.8 mm longis 4–7 mm separatis simulantibus sed subadpressis, midnervo infra cum aculeis 1.7–2 mm longis 6–15 mm separatis simulantibus adscendentibus, proxima apicem marginibus cum serris 0.1–0.3 mm longis 1–4 mm separatis adpressis cum apicibus subulatis, midnervo infra cum serris 0.2–0.6 mm longis 2.5–6 mm separatis simulantibus, pedunculo terminali 7 cm longo 3–4 mm diametro folioso-bracteato, syncarpio solitario pendenti 36 mm longo, 35 mm diametro elliptico-subgloboso cum circa 230 drupis, eis 14–16 mm longis 4–4.2 mm latis 3 mm crassis anguste oblanceoloideis 5–7-angulis lateribus subcurvatis parte $\frac{1}{4}$ supera libera, pileo conico sed in sicco cum rugis longitudinalibus, stylo 2.5–3 mm longo crasse subulato cartilagineo pallido proximo-curvedo, stigmate 2–2.5 mm longo lanceolato proximo brunneo papilloso, endocarpio centrali 6 mm longo anguste obovoideo cartilagineo obscure brunneo intra lucido lateribus 0.1 mm crassis, mesocarpio apicali lateralique conjuncto sicco et meduloso, mesocarpio basali fibroso et carnoso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Branching shrub 1.5 m tall; stem 8–10 mm in diameter, yellowish, unarmed; prop roots not mentioned; leaves 35–50 cm long, 6–10 mm wide, subcoriaceous, ligulate, flat or the margins slightly involute, at midsection with 13 parallel secondary veins in each half, the upper $\frac{1}{3}$ gradually tapering to the acute tip, this 10 cm from the apex 4 mm wide, when dried pale and below somewhat glaucous, the very base amplexicaul and unarmed, near the base the margins with prickles 1.8–2.2 mm long, 8–15 mm apart, ascending, arcuate subulate, stramineous; the nearby midrib below with similar ascending prickles 2.2–2.5 mm long, 8–25 mm apart; at midsection the margins with prickles 1.3–1.8 mm long, 4–7 mm apart, similar but subap-

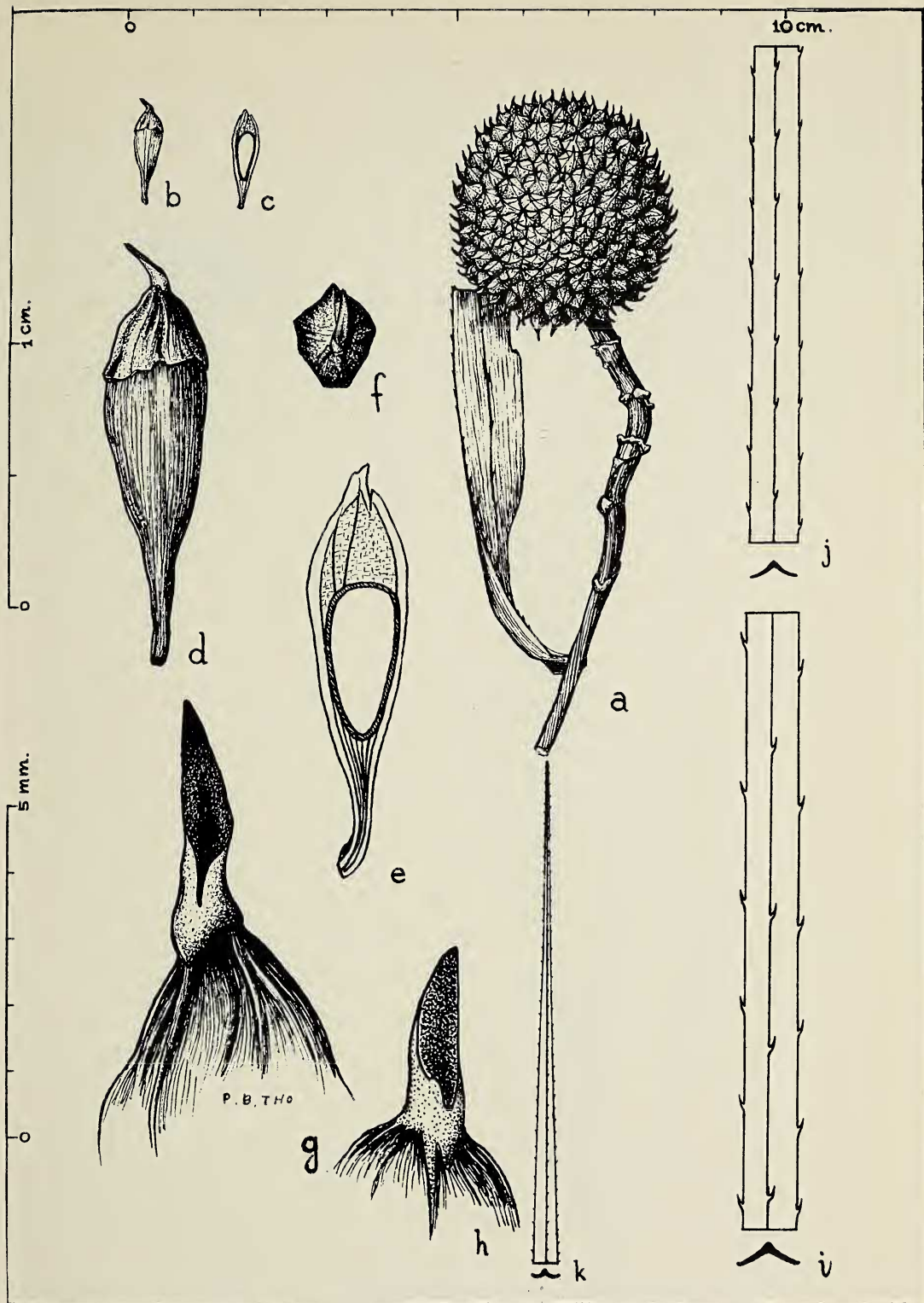


FIG. 202. *Pandanus thailandicus* St. John, from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, apical view, $\times 4$; *g, h*, apex of drupe and stigma, proximal view, $\times 10$; *i*, leaf base, lower side, $\times 1$; *j*, leaf middle, lower side, $\times 1$; *k*, leaf apex, lower side, $\times 1$.

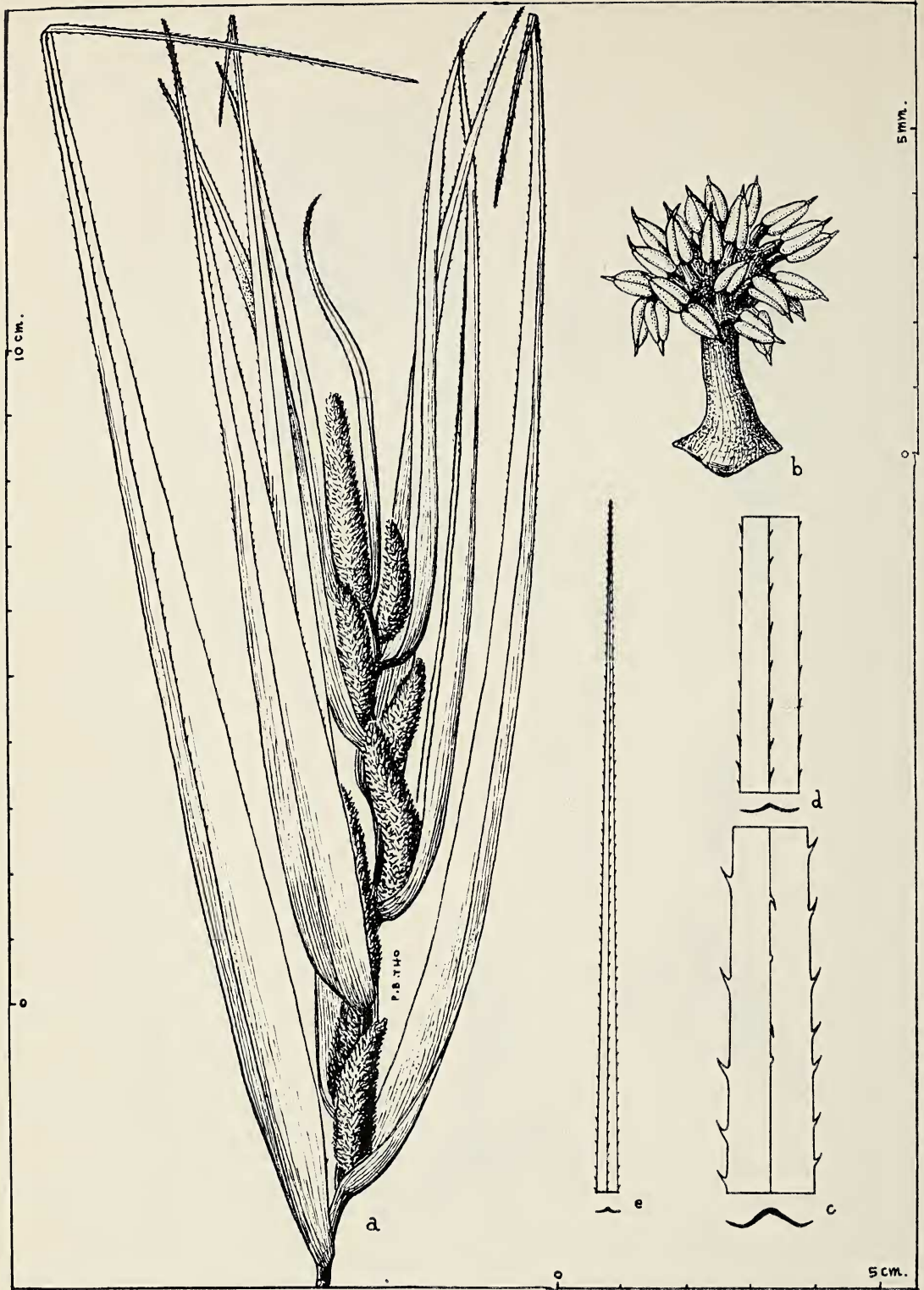


FIG. 203. *Pandanus thailandicus* St. John, from *Dee Bun Phong* 914. *a*, Staminate inflorescence, $\times 1$; *b*, column and anthers, $\times 10$; *c*, leaf base, lower side, $\times 1$; *d*, leaf middle, lower side, $\times 1$; *e*, leaf apex, lower side, $\times 1$.

pressed; the midrib below with similar prickles 1.7–2 mm long, 6–15 mm apart, ascending; near the apex the margins with subulate-tipped appressed serrations 0.1–0.3 mm long, 1–4 mm apart; those of the midrib below similar but 0.2–0.6 mm long, 2.5–6 mm apart; peduncle terminal, 7–12 cm long, 3–4 mm in diameter, with many leafy bracts, the median ones 21 cm long, 8 mm wide, the upper ones 7 cm long, 17 mm wide, foliaceous, white; syncarp single, pendent, elliptic-subglobose, 36–55 mm long, 35–42 mm in diameter, bearing 230–592 drupes, these 14–19 mm long, 4–4.2 mm wide, 3 mm thick, narrowly oblanceoloid, 5–7-angled, the sides gently curving, upper $\frac{1}{4}$ free; pileus conic, but when dry with longitudinal wrinkles, the base connate with adjacent ones, leaving no visible suture; style 2–3.5 mm long, stout subulate, pale, cartilaginous, curved upward towards apex of syncarp (or the basal ones curved distally); stigma 1.5–2.5 mm long, lanceolate, proximal, brown papillose; endocarp central, 6 mm long, narrowly obovoid, cartilaginous, brown, shiny within, the walls 0.1 mm thick; apical and lateral mesocarps continuous, dry pithy; basal mesocarp fibrous and fleshy.

STAMINATE PLANT: Stem 8 cm or a little more in height, 7–10 mm in diameter, dark brown, striate, shining; leaves numerous in terminal tuft, 46–48 cm long, just above the base 12–13 mm wide, at the middle 7–8 mm wide, green, secondary parallel veins prominent throughout and at midsection 14 in each half, the base amplexicaul, unarmed, softer, beginning 3.5–4 cm up the margins with prickles 2.3–3.5 mm long, 5–15 mm apart, arcuate, heavy subulate, ascending, yellow; the nearby midrib below beginning at 5–5.5 cm with prickles 2–2.5 mm long, 6–15 mm apart, similar but reflexed, at the point of reversal of direction often paired; at midsection the margin and midrib below with similar prickles 1–2.5 mm long, 4–6 mm apart, ascending; staminate inflorescence terminal; peduncle 6 cm long, 1.5 mm in diameter, leafy bracted; floral part 11 cm long; lowest floral bract about 45 cm long, the base 15 mm wide, soft, white, veiny, unarmed, narrowly lanceolate, the upper part 6 mm wide, green, subcoriaceous, at midsection the margins with prickles 0.5–1 mm long, 2–3 mm apart, arcuate subulate, ascending, yellow; the midrib below with similar

ones 0.3–0.5 mm long, 1.5–3 mm apart; the 7 spikes fragrant, 2.3–3 cm long, 6–8 mm in diameter, narrowly ellipsoid, densely flowered; stamens numerous, in fascicles; staminal column 2–2.5 mm long, stout, but tapering upwards; free filament tips 0.5 mm long; anthers 0.7–0.8 mm long, lanceolate, bearing on its apex a subulate projection of the connective 0.2 mm long.

HOLOTYPE: Thailand (Siam): Pü Wieng, Kawn Ken, by dry stream bed, 300 m. alt., Feb. 7, 1931, *A. F. G. Kerr* 20,016 (BK).

SPECIMENS EXAMINED: Thailand (Siam), Bung, Ubon, by stream in open forest, 100 m. alt., Jan. 29, 1924, *A. F. G. Kerr* 8,365 (BK); n. e. part, Loei, Phu Luang, by stream, 1,000 m. alt., 24 Sept. 1957, *Dee Bun Pheng* 914, staminate and pistillate (BKF no. 16,154).

DISCUSSION: *P. thailandicus* is a member of the section *Rykia*, as is its closest relative, *P. immersus* Ridl. of Malaya, a species with the syncarp (immature) 9.5 cm long, 6 cm in diameter, ellipsoid, with about 1,440 drupes, these 5–6 mm wide; pileus 7–8 mm long; style 4–6 mm long; plant aquatic; leaves "many feet long," 10.2 cm wide, caudate subulate apex 30 cm long, at midsection with 70 secondary veins in each half, and the margins with prickles 2.5–4 mm long, 9–18 mm apart. *P. thailandicus* has the syncarp 3.6–5.5 cm long, 3.5–4.2 cm in diameter, elliptic-subglobose, with 230–592 drupes, these 4–4.2 mm wide; pileus 3.5–6 mm long; style 2–3.5 mm long; plant terrestrial; leaves 35–50 cm long, 6–10 mm wide, the subulate apex 7 cm long, at midsection with 13 veins in each half and the margins with prickles 1.3–1.8 mm long and 4–7 mm apart.

The new epithet is geographic, referring to the native country of the species.

Pandanus unicornutus sp. nov. (sect. *Rykia*)

Fig. 204

NOM. VERN.: "chawng lī"; "tôi yai."

DIAGNOSIS HOLOTYPI: Arbor ad 8 m alta ramosa, foliis "ad 3.5 m. longis" 10–11 cm latis proxima basem crassiter coriaceis in apice subulato 8 cm longo abrupte contractis eo 10 cm ex apice 7 mm lato in sectio late M-formati in puncto 30 cm ex basi cum 70 nervis secundariis in quoque latere, basi integra et amplexicauli sed ex 15 cm marginibus cum spinis 4.5–6 mm longis

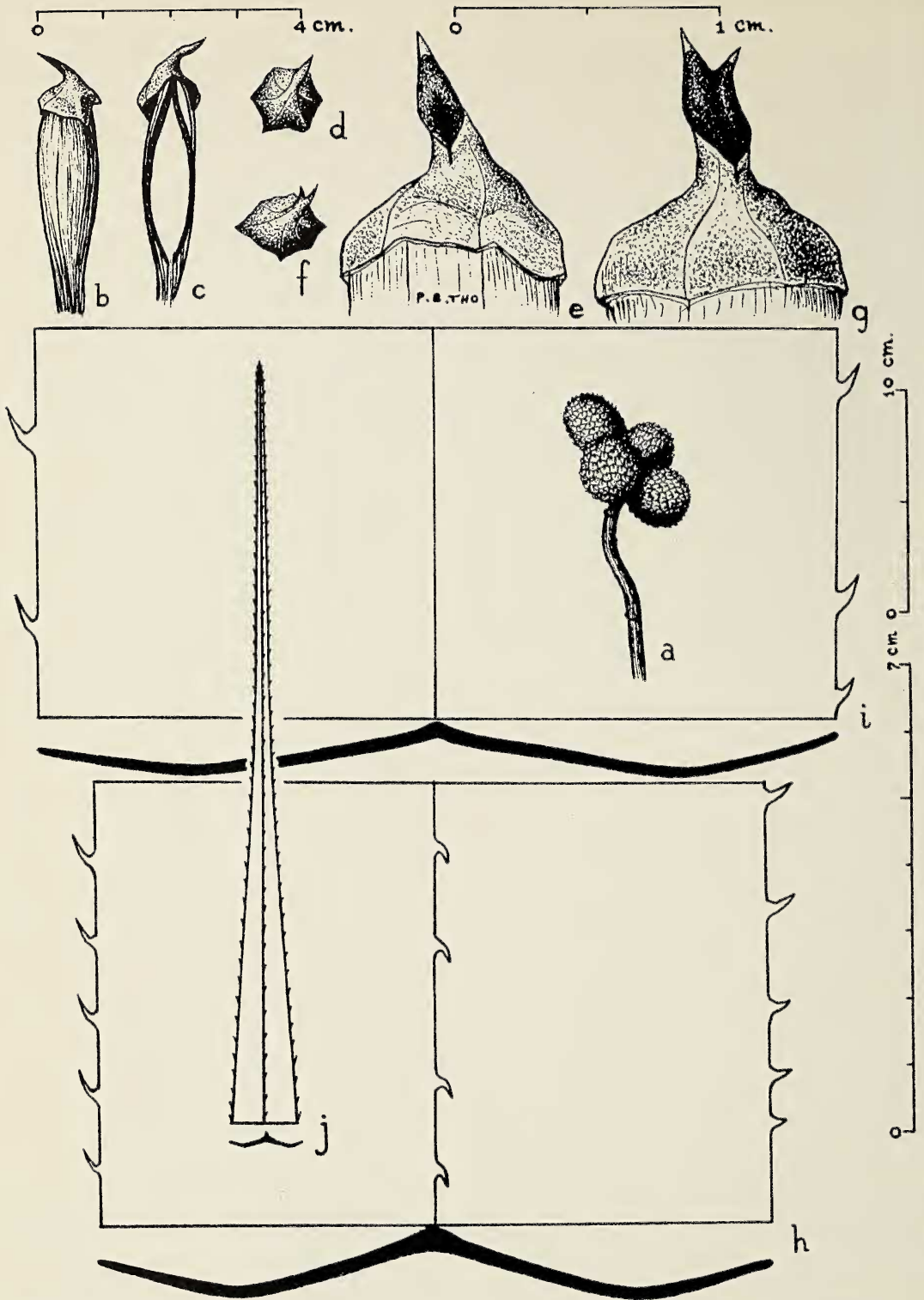


FIG. 204. *Pandanus unicornatus* St. John, from holotype. *a*, Inflorescence, $\times \frac{1}{3}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, apical view, $\times 1$; *e*, drupe apex and stigma, proximal view, $\times 4$; *f*, rare drupe apex with bifid stigma, apical view, $\times 1$; *g*, apex of rare drupe with bifid stigma, proximal view, $\times 4$; *b*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.



FIG. 205a. *Pandanus bipollicaris* St. John, from holotype. Branch, leaves, and syncarp.



FIG. 205b. *Pandanus bipollicaris* St. John, from holotype. Branch, leaves, and syncarp, and longitudinal median section of syncarp.

7–15 mm distantibus basi crassa apice subulato subarcuatis divergentibus vel subadscendentibus pallide brunneis, midnervo infra cum spinis 4–5 mm longis 10–41 mm distantibus crasse conico-subulatis reflexis, in sectio mediali foliis 12.5–13 cm latis in paginis ambis rugoso-reticulatis marginibus cum spinis 4–6 mm longis 21–38 mm distantibus adscendentibus basi crassa apice crassiter subulato, midnervo inermi, proxima apicem marginibus et midnervo infra cum serris subulatis 0.5–0.8 mm longis 2–4 mm distantibus paginis ambis rugoso-reticulatis, laminis in sectio M-formatis fere ad apicem, spicis cum 7 syncarpiis, “syncarpio maximo 15 cm. longo” 11 cm diametro, drupis multis 3.5–3.9 cm longis 8–10 mm latis crassisque anguste ellipsoideis lateribus laevibus planis vel subcurvatis 5-angulatis parte 1/7 supera libera, pileo oblato-semiorbiculari firmo quoque solum dehiscenti, stylo 6–8 mm longo osseoso corniformi integri (rariter bifido) proxime curvato pallide brunneo, stigmatibus 3–4 mm longo lanceolato brunneo papilloso, endocarpio submediali 25 mm longo lateribus 0.1 mm crassis cartilagineo stramineo pagina interiori lucido apice lanceoloideo producto, seminibus 15–16 mm longis 5–6 mm

diametro ellipsoideo, mesocarpio apicali in marginibus fibroso intra cavernoso, mesocarpio basali fibroso et carnoso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree 7–15 m tall, 17–20 cm in diameter, branching; bark pale, with short spines; “prop roots to 1 m. long, 5–8 cm. in diameter, armed with short spines”; leaves “3.2–3.85 m. long,” 8.4–11 cm wide near the base, thick coriaceous, abruptly acuminate to a subulate apex 8 cm long, the tip 10 cm down from the apex 7 mm wide, very wide M-shaped in section, at 30 cm from the base with 70 secondary veins in each half, the base entire and amplexicaul, but beginning 15 cm up the margins with thorns 4.5–7 mm long, 7–15 mm apart, heavy based, subulate-tipped, somewhat arcuate, divergent or slightly ascending, pale brownish; the midrib below with thorns 4–5 mm long, 10–14 mm apart, heavy conic-subulate, reflexed; at midsection 12.5–13 cm wide, both surfaces rugose reticulate, the margins with thorns 4–6 mm long, 21–38 mm apart, ascending, the base heavy, the tip thick subulate; the nearby midrib prominent but unarmed; near the apex the margins and midrib below subulate-serrate, the teeth 0.5–0.8 mm

long, 2–4 mm apart, both the upper and lower surfaces rugose-reticulate from the heavy cross veinlets, the blade M-shaped in section and the pleats running almost to the tip; peduncle 70 cm long; spike with 5–7 syncarps, the largest 14–18 cm long, 11–12 cm in diameter, ovoid but distinctly 3-sided; drupes numerous, these 3.5–4.3 cm long, 8–10 mm wide and thick, narrowly ellipsoid, the sides smooth, plane or gently curved, 5-angled, upper 1/7 free; pileus oblate-semiorbicular, firm, shedding singly, ending in a style 6–8 mm long, bony, horn-like, entire (rarely bifid), strongly curved towards the apex of the syncarp, pale brownish; stigma 3–4 mm long, lanceolate, brown papillose; endocarp slightly submedian, 25 mm long, the lateral walls 0.1 mm thick, cartilaginous, stramineous, the inner surface shining, the apex produced upwards into a long lanceoloid tip; seeds 15–16 mm long, 5–6 mm in diameter, ellipsoid; apical mesocarp fibrous around the margin, cavernous within; basal mesocarp fibrous and fleshy.

HOLOTYPE: Thailand (Siam), Kaw Tao, Surat, in high evergreen forest, under 5 m. alt., April 16, 1927, *A. F. G. Kerr* 12,772 (BK).

SPECIMENS EXAMINED: Thailand (Siam), Kaw Tao, Surat, evergreen forest, 300 m. alt., Sept. 21, 1928, *A. F. G. Kerr* 16,052 (BK); Wangka, Kanburi, by stream in evergreen forest, 700 m. alt., Feb. 3, 1926, *A. F. G. Kerr* 10,432 (BK); Ta Ngaw, Chumpawn, common along streams in savannah evergreen [forest], Jan. 22, 1927, *A. F. G. Kerr* 11,601 (BK).

DISCUSSION: *Pandanus unicornutus* is a member of the section *Rykia*, as is its closest relative, *P. penangensis* Ridley, a Malayan species which has the drupes 42–47 mm long, 6–7 mm thick; endocarp 32–33 mm long, the lateral walls 1–1.5 mm thick; and the leaves 12 cm wide, near the base the margins with prickles 1.3–1.5 mm long, 4–7 mm apart. *P. unicornutus* has the drupes 35–43 mm long, 8–10 mm thick; endocarp 25 mm long, the lateral walls 0.1 mm thick; and the leaves 10–11 cm wide, near the base the margins with spines 4.5–6 mm long, 7–15 mm apart.

The epithet is from the Latin *unus*, one, *cornutus*, with a horn, in allusion to the usual single hornlike style.